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ABSTRACT

Designed to investigate the relationship between student and teacher attitudes concerning the study of mathematics and attitudes toward scientific and technical careers by sex and to provide inservice training in eliminating sex role stereotyping in the teaching of mathematics, a research project assessed students' mathematics achievement and developed unit plans incorporating career education concepts. Research involved pre- and post-surveys of the math ability of students and of the attitudes of teachers and students toward technical and scientific careers and toward sex-role stereotyping. The instruments used were the California Test of Basic Skills and project-developed surveys scaling teacher and student attitudes toward mathematics and occupations. A major unit topic was identified and a career awareness unit with student activities in that area developed for each grade involved: measurement (grade 3), addition and subtraction of fractions (grades 4 and 5), multiplication and division of fractions (grade 6), decimals (grade 7), and percentages and business mathematics (grade 8). Data analysis generally indicated large increases in scores of male and female students on the occupational preference survey and the mathematic achievement test. (Unit plans are presented with lesson plans including objectives, teaching strategies, materials needed, lesson development, and activities. Survey instruments are appended.) (YLB)

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ED182433

"EXPANDING CAREER CHOICES FOR STUDENTS BY REDUCING MATHEMATICS ANXIETY"

Project No. SSBG 914

New Jersey Department of Education

Division of Vocational Education

Trenton, New Jersey

Project Director

Mr. Jack DeTalvo

Mathematics Supervisor

Asbury Park, New Jersey

Research and Curriculum Consultants

Anne M. Claytor, S.C., Ed. D.

Antoinette J. Messina, Ed.D.

Asbury Park, New Jersey

July, 1979

CE 023 684

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Chapter 1

Introduction

This project on "Expanding Career Choices for Students by Reducing Mathematics Anxiety" was funded by the Department of Education of the State of New Jersey, Division of Vocational Education and Career Preparation. The results of this study will be made available to the Office for Equal Access on Vocational Education and Career Preparation. The purpose of the study is aimed at researching the mathematics achievement of students in grades 3 through 8 and their preference for career choices. It is also concerned with teachers' attitudes toward mathematics and the choices of scientific and technical careers. A major concern is the attitudes that exist toward sex role stereotyping both in the student and teacher population.

The project evaluation was conducted by pre- and post-test surveys of mathematic ability of students, attitudes of teachers and students toward mathematics and sex role stereotyping in occupations.

Statistics

The Asbury Park School enrollment as of September 29, 1978, totaled 3,442. The total is about equally divided between male(1,752) and female (1,690) students. The number of students in grades one thru eight totaled 2,218 and from grades nine thru twelve totaled 1,224 (males-601, females-623). There were 95 students in special education (male-68, female-27) and 138 students in work-study programs (male-85,female-53). The Asbury Park School District is in an urban area with its students population from a low socio-economic background. A total of 2,440 (71%) students receive free lunches and 108 are charged reduced sums. Thus, 74 percent of the students are receiving free and reduced lunches. Approximately 100 students drop-out each year or 3 percent of the student enrollment.

Ethnicity

Seventy-two percent (2,486) of the total enrollment is comprised of black students, about equally divided between males and females (male-1,224 , female-1,262). The white student population numbered 706 (21%) or 391 males and 315 females. The Hispanic student enrollment was 232 (7%) about equally divided between males and females; while the Asian or Pacific Islander was only 18 in total number.

Class of June 1978

As shown by Table 1, 56 percent of the students of the class of June 1978 are pursuing higher education (4-year college 87 or 40% and 2-year college 34 or 16%). Considering the socio-economic level of the

Table: 1

CLASS OF JUNE, 1978

Number of June, 1978 Graduates	218	
Number of Non-Graduates	18	
Number and % enrolled in 4-year colleges or universities	87	39.91%
Number and % enrolled in 2-year colleges	34	15.60%
Total number and % pursuing higher education	121	55.51%
Number enrolled in secretarial and business schools	1	
Number enrolled in technical, nursing and special schools	4	
Total number and % pursuing education in schools of non-college grade	5	2.29
Total number and % pursuing post-secondary education	126	57.80
Number and % of graduates entering armed services	20	9.17
Number and % who have full-time permanent employment	35	16.05
Number and % undecided and/or looking for employment	33	15.14
Number and % of graduates - homemaking	2	.92
Number and % of graduates - miscellaneous (unable to work)	2	.92

Source: Asbury Park Guidance Department

students in the School District these figures represent high interest in further education. The figure of 33 or 15 percent for students undecided about a career and/or looking for employment is high and indicates the above average unemployment rate in major urban areas in New Jersey and probably the Nation. According to the statistics maintained by the Guidance Department the total of "undecided and/or looking for employment" has increased each year from 1972 thru 1978 (7%-15%).

Classes 1972-1978

Table 2 shows what graduates are doing for the years 1972 thru 1978. During this time period the total number of students pursuing higher education ranged form 45% to 58%; in recent years enrollment in Technical, Business and Nursing Schools showed a decline and during the same time period ranged from 2 percent to 8 percent; preference for Military Service in recent years showed an increase with a range of 2 percent to 12 percent; employment has decreased from 1976 to 1978 and the range since 1972 was 23 percent to 16 percent.

State's First Collegiate Basic Skills Test

According to an article in the Sunday Star-Ledger of December 10, 1978, page one, "students from urban areas performed very poorly on the state's first collegiate basic skills test - with failure rates ranging from 50 percent to more than 85 percent, depending on the district and the subject tested". According to the article the statistics were released by the State Board of Higher Education to pressure public schools into "correcting skill deficiency problems at the elemen-

Table: 2

FOLLOW UP OF HIGH SCHOOL GRADUATES

CLASS OF JUNE	4 YEAR COLLEGE	2 YEAR COLLEGE	TOTAL HIGHER EDUCATION	TECH., BUS. NURSING SCHOOLS	TOTAL POST SECONDARY EDUCATION	MILITARY SERVICE	HAVE EMPLOY-MENT	UNDECIDED OR LOOKING FOR EMPLOYMENT	OTHER
1978	39.91%	15.60%	55.51%	2.29%	57.80%	9.17%	16.05%	15.14%	1.84%
1977	32.05%	16.24%	48.29%	5.56%	53.85%	12.39%	17.52%	14.96%	1.28%
1976	39.91%	18.46%	58.37%	3.86%	62.23%	2.58%	18.88%	15.02%	1.29%
1975	30.34%	14.96%	45.30%	8.12%	53.42%	5.56%	27.35%	11.97%	1.70%
1974	34.24%	17.57%	51.81%	6.75%	58.56%	1.35%	25.22%	12.61%	2.26%
1973	34.35%	17.39%	51.74%	6.96%	58.70%	1.30%	28.70%	9.57%	1.73%
1972	40.90%	16.72%	57.62%	8.17%	65.79%	2.23%	22.68%	6.70%	2.60%

Source: Asbury Park Guidance Department

Table 3

1978 - 1979 FREE AND REDUCED LUNCH COUNT

SCHOOL	FREE	REDUCED
PRE-SCHOOL HANDICAPPED	25	0
PRE-SCHOOL	68	0
HIGH SCHOOL	532	17
MIDDLE SCHOOL	801	50
BANGS AVENUE SCHOOL	594	9
BOND STREET SCHOOL	229	4
BRADLEY SCHOOL	191	28
Total	2,440	108
Grand Total	2,548	

bh
12/78

Table 74

DIVISION OF SCHOOL PROGRAMS

Bureau of Special Education and Pupil Personnel Services

1977-78 SURVEY OF SCHOOL AGED PREGNANCIES

County Monmouth
County Code 25

District Asbury Park
District Code 0100

This information request is to determine the number of school aged pregnancies and the types of programs offered to these girls for the school year 1977-78.

1. What was the total number of school aged pregnancies in your school district for the school year 1977-78? 36

2. For the following, count each student only once. Select the major program participation by the student. Total of #1 must be the same as #2:

a. Continue to follow their regular school program ____

b. Participated in an adjusted regular school program 16

c. Participated in special education class ____

d. Participated in some other special education program (Explain) ____ ____

e. Received individual (home) instruction 7

f. Withdrew or dropped out of school 10

g. Other (specify) terminated pregnancy 3

Total (Total of #1 must be the same as #2) 36

Michael F. DeRosa
Signature of Respondent

DE

Table 5

Consolidated On Roll Report: CURRENT SCHOOL ENROLLMENT DATA

As of September 29, 19 78

nty MONMOUTH Code 2 5 District ASBURY PARK CITY Code 0 1 0 0 School

A ON ROLL BY GRADE, RACE AND SEX

	GRADE	White*		Black*		Hispanic		American Indian or Alaskan Native		Asian or Pacific Islander		ALL STUDENTS		
		M	F	M	F	M	F	M	F	M	F	M	F	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
A01	Pre-Kindergarten	15	11	37	32	1						53	43	96
A02	Kindergarten	11	7	92	86	1	9					112	102	214
A03	One	8	9	82	84	15	7					105	100	205
A04	Two	9	12	81	101	8	12			1		99	125	224
A05	Three	14	9	120	109	4	15					138	133	271
A06	Four	6	13	88	81	15	9					109	103	212
A07	Five	7	11	98	81	5	9					110	101	211
A08	Six	14	6	82	91	12	7					108	104	212
A09	Seven	13	6	104	104	10	9					127	119	246
A10	Eight	12	6	89	97	11	7					112	110	222
A11	Nine	89	71	92	107	10	5			1	1	192	184	376
A12	Ten	56	63	68	101	9	8			2	1	135	173	308
A13	Eleven	70	49	86	99	6	8			5	2	167	158	325
A14	Twelve	53	35	54	69	7	2			3	2	117	108	225
A15	Post-Graduate													
A16	Special Education**	14	7	51	20	3						68	27	95
A17	Ungraded													
A18	TOTAL ****	391	315	1224	1262	125	107			12	6	1752	1690	3442
A19	Shared Time Students Received***	35	13	42	38	6	2			2		85	53	138

B AVAILABLE PR

	PROGRAM
	(1)
B01	State Compensatory
B02	Community Service
B03	Gifted/Talented
B04	Advanced Placement
B05	Special Education
B06	Bilingual
B07	Shared Time
B08	Continuing Education
B09	Alternate School
B10	Open Classroom
B11	Pregnant Students
B12	Vocational Education
B13	Industrial Arts
B14	Introduction to Vocations
B15	Technology for Children

C. Number of students who are from less than $6930 (for N.D.S.L.).

* Non-Hispanic

** Include here only student housed in special education classes

*** Count each shared time student received as ONE

**** Total must agree with State Aid Application. Any differences must be explained in writing.

COPY DISTRIBUTION:

1. WHITE - State Copy
2. CANARY - County Copy
3. PINK - District Copy
4. GREEN - School Copy

PREPARED BY:

tary and secondary level.

Students from theAsbury Park School District were among the ten urban districts classified as the poorest performers on the state's Minimum Basic Skills (MBS) Test. Seventy-three percent of the students in Asbury Park showed unsatisfactory English scores. On the Computation Test, Asbury Park posted a 73 percent rate and the algebra scores were 67 percent.

The statistics first released in November by the college sector indicated that 43 percent of the 43,000 high school seniors admitted to New Jersey's public colleges in 1978 would need remedial work in reading, writing or mathematics and in some cases all three. Students admitted to Rutgers and NJIT had the best basic skill scores, followed by those in the state colleges and, finally, by those admitted to the county schools.

Profile of Teachers in Experimental Group

The six teachers participating in the experimental group range in age from 23 to 34 with the majority in the higher area. One teacher did not respond. For the most part, the teachers attended local schools with five holding Bachelor of Science degrees and one holding a Bachelor of Arts degree. Of these teachers, three hold a degree at the masters level (Master of Science, Master of Education and Master of Arts). Although two teachers did not report the major field of study, the remaining stated the following:

Number	First Degree	Number	Second Degree
1	Mathematics/elementary education	1	Supervision
2	Elementary Educ.	1	Administration
1	Biology	1	Urban Education

The teachers graduated from the folowing schools with State and local schools dominating:

School	Number
Monmouth College	2
Trenton State College	2
Morgan State College	1
Finlay College	1
Kean State College (M.A.)	1

Four of the teachers were non-education majors before deciding on a career in teaching and two reported they only studied education. Years of teaching experience among the participants ranged from 2 to 13 years with most being in the higher range. Salaries reported were from a low of $10,580 to a high of $19,000 with three of the reporting teachers above $14,000. One teacher did not report an income figure.

With the exception of two teachers who were not involved in professional and civic organizations, the remaining four participate in the following:

Number	Organization
4	NJEA
3	NEA
3	APEA (Asbury Park Educational Assoc.)
1	MCTA (Monmouth County Teachers Assoc.)
2	PTA
1	NAACP
1	Negro Women Business and Professional Club (Treasurer)
	Church Group

Profile of Teachers in Control Group

As the experimental group of teachers, the control group consists of a teacher for each grade 3 thru 8. However, the eighth grade teacher decided not to participate in the survey. The remaining five teachers responded to most questions except the one to specify gross income. Only one teacher responded.

The control group of teachers are older and have more teaching experience than the experimental group. Two respondents reported ages slightly above fifty years and one reported an age of 26. Two teachers preferred not to respond. The schools attended with degree and major follows:

School	Major	Degree
Morehouse College	Math	B.A.
Daniel Payne College	n.r.	n.r.
Kean State College	El. Ed.	B.S.
Paterson State College	El. Ed.	B.S.
Monmouth College	El. Ed.	B.S.

n.r. = not reported

The control teachers, similar to the experimental group, had a majority attending State and local schools.

Only one of the five respondents was a non-education major and again only one had other experience than teaching. Years of teaching experience were higher for the control group than the experimental group with a range of 6 to 21 years. Three control teachers had no previous positions before Asbury Park and one teacher had 2 and another had 1. Only one gross salary was reported ($21,200).

The control teachers, as those in the experimental group, hold membership in professional organization. The list is as follows:

Number	Professional Organization
3	APEA (Asbury Park Educational Assoc.)
2	MCEA (Monmouth County Educational Assoc.)
3	NJEA
3	NEA

The following is a list of memberships in civic organizations.

Number	Civic Organization
1	NAACP
1	Westside Community Center
1	WIBC (President)

Addendum to Profile of Teachers

After the pre-testing and the Second Workshop for Teachers, the Asbury Park Board of Education approved the change of teachers for the sixth grade. The sixth grade teacher who was in the "Control Group" was changed to the "Experimental Group". This teacher has six years of teaching experience and attended Daniel Payne College and Monmouth College.

A new teacher was selected for the "Control Group". The teacher is a 1978 graduate of Kean College with a degree in Elementary Education.

Chapter II

Methods and Procedures

On October 14, 1978, the researchers sent to Mr. Jack DeTalvo, Supervisor of Mathematics for the Asbury Park School System, a Calendar 1978-1979, listing the work schedule for the "Mathematics Project".

On October 5, 1978, Mr. Jack DeTalvo, Sister Anne M. Claytor and Ms. Antoinette J. Messina met with Ms. Martha J. Posci, Supervisor, Office of Equal Access Division of Vocational Education of the State Department of Education to discuss the "Mathematics Project" funded by them. A letter explaining the information the Department desired to obtain from the research project was give to Sister Anne Claytor by Mr. Jack DeTalvo. Briefly the research will include a pre and post survey of the math ability of students, attitudes of teachers and students toward technical and scientific carrers and toward sex role stereotyping. As part of the project a major unit topic in each grade will be identified. A career awareness unit will be developed which will include student activities in the area. These units will be written by the curriculum specialist in cooperation with participating teachers. The units will be ready for classroom testing by the spring of 1979.

On December 1, 1978, the researchers met with Mr. Jack DeTalvo to prepare the presentation to the six participating teachers representing grades 3-8. Later that afternoon a meeting was held at the Middle School and those present were: Mr. Jack DeTalvo, Supervisor; Researchers, Sister Anne M. Claytor and Ms. Antoinette J. Messina. The teachers present were: Enid Pickett and Bonnie Revman from Bradley School; Lena Vetrano, Eunice Taylor, William Rosen and David Nash from the Middle School.

The Project was explained to the participating teachers who are each receiving a stipend of $150 for their particiaption. They were told to obtain a counterpart teacher in their grade level to be part of the control group. Distributed at the meeting to be completed by the end of December were:

1. Attitude Surveys (Students and Teachers)
2. Occupation Survey (Students and Teachers)
3. Personal Data Sheet (Teachers)

At the meeting the participating teachers were told to begin formulating ideas to be incorporated in a Unit Plan which they will use in order to accomplish change which will be reflected in the post-testing.

Instruments

Mathematics Achievement Scores

The mathematics achievement scores were obtained by the teachers by administering the California Test of Basic Skills. All students participated in this uniform test. For transfer students, in order to obtain an equivalent score, the Wide Range Achievement Test by McGraw Hill was administered. The control and experimental classes participating in this research project were selected on the basis of high achievers in mathematics.

Teachers Attitude Towards Mathematics

The instrument used to measure teacher attitude toward mathematics was devised with ten positive and ten negative statements, on a three point scale. (See Appendix) The teachers were asked whether they "Agree", were "Uncertain", or "Disagreed" with the statements. Some of the statements asked concerned: interest in mathematics, security in teaching mathematics, enjoyment in taking mathematics courses, dislike for mathematics, nervousness in teaching mathematics and fear of mathematics.

The grading of the instrument was as follows:

Positive Statements 3,4,5,9,11,14,15,18,19,20

Disagree = 0
Uncertain = 1
Agree = 2

Negative Statements 1,2,6,7,8,10,12,13,16,17

Disagree = 2
Uncertain = 1
Agree = 0

Teacher and Student Attitudes Towards Occupations

The same instrument was devised to measure student and teacher attitudes towards occupations on a three point scale. (See Appendix) The scale included

the categories of "Both", "Female" and "Male". Fifty-one occupational titles were listed from the professional to the unskilled. A sampling of the occupations in the instrument are: architect, judge, pilot, flight attendant, artist, chemist, baker and chauffer.

Two types of scoring were used in attitude towards occupations. The first score obtained was a count of the total of each of the three columns, "Both", "Female" and "Male". This procedure was necessary in order to determine the student and teacher emphasis in the three categories. Also used for scoring, was a weighted average of 3, 2 and 1 for "Both", "Female" and "Male", respectively.

Student Attitude Towards Mathematics

The attitude toward mathematics as prepared by Psychologists and Educators, Inc. was used for students in grades three thru eight. The Mathematics Supervisor of the Asbury Park School District determined which reading level attitude instrument was to be used for each grade. The "Elementary" instrument was used for students in grades three through six.

Although the reading level was different, the instruments were exact. (See Appendix)

The instrument "Attitude Toward Mathematics" has a four point scale of "No", "Sometimes", "Usually" and "Yes". The student was instructed to blacken the circle according to how he/she feels. It was stated on the instrument that the teacher would not see it.

The instrument has fifteen statements, eight which are positive and seven which are negative. The scoring was as follows:

Positive Statements 2,3,5,7,10,11,13,14

No = 0
Sometimes = 1
Usually = 2
Yes = 3

Negative Statements 1,4,6,8,9,12,15

No = 3
Sometimes = 2
Usually = 1
Yes = 0

(Missing = 2) invalid if more than two statements are missing.

First Teachers' Workshop

The researchers, Sister Anne M. Claytor and Dr. Antoinette J. Messina, on January 9, 1979 at 3:30 p.m. conducted at the Middle School the First Workshop for the teachers in the experimental group. Five of the six participating teachers were present.

The format of the workshop was a slide presentation with intermittent discussions. The 135 slide presentation was prepared by Women on Words and Images, Inc. of Princeton, New Jersey, and was entitled Help Wanted: Sexism in Career Education Materials. The first part of the slide showing emphasized materials selected for study which were supposed to be free of sex bias. It was found that most materials were all male-dominated except for a high school home economics text which was female dominated. The slides showed role models for boys were unlimited. Female role models were for the most part, limited and predictable and were not in positions of authority with decision making responsibilities. Females are portrayed in traditional roles.

The slide presentation also depicted traits a young man finds necessary to succeed in life and in a career, while for the most part the advice given to young women deals with grooming. Thus children in the career education materials are shown in stereotyped ways. In the career materials, boys aspire to any and all careers with interest, seriousness and enthusiasm. Boys' futures always involve careers while career aspirations for girls are rarely discussed and when they are, they are for the most part stereotyped along traditional roles.

The career materials reviewed contained sexist language as the slides showed the generic "he" or the word "man" was used to mean "people". The U.S. Census Bureau has reclassified 55 of the 441 job occupation titles to non-sexist terms such as flight attendant and letter carrier. Some material examined showed men and women in non-traditional jobs and roles, for instance, a male dietician. However, in the final tally, 228 occupations showed male examples and only 98 had female pictures.

The slides shown portrayed some material encouraging women to enter non-traditional careers and the changing role of women. But often the materials qualify women's career options by linking them with family responsibilities. Men's career options are never qualified or linked with housekeeping or childcare. Their only responsibility is financial.

Experience with school readers has shown that publishers are slowly becoming aware of unfair limitations of sex role stereotyping. The general superiority of one sex over the other in any job related skill is not supported by any conclusive evidence. All children should believe that they can be whatever they want to be.

A discussion ensued with the researchers and five participating teachers. The teachers were asked to react to the following statements:

a. Women are weaker than men. They shouldn't try to do heavy physical work.

b. A woman's place is in the home.

c. Women can't be good lawyers because they are too emotional.

d. Women should never try to supervise men in a working situation; they don't know how to be bosses.

Table 6

Chart of Role of Men and Women

Areas of life	Role of Men		Role of Women	
	Traditional	Now	Traditional	Now
Household Responsibilities				
Financial Responsibilities				
Earning Power				
Having Educational Options				
Place in the Work Force				
Getting Married				
Dressing Fashionably				
Being Politically Active				
Decision-making in Use of Leisure Time				
Responsibility for Care of Children				
Having Freedom of Movement				

Source: Women at Work: Choice and Challenge Part II

The participating teachers were given as shown in Table 6 and told that using a scale of one to five in ascending order of priority or importance to fill out the chart. Also use this as a basis to discuss how society has been affected by the changing role of women. A discussion followed.

The researchers then asked: "Who are some of the role models that today's students can identify with in selecting new and non-traditional careers? What are some of the obstacles that have confronted these women?" A discussion followed.

Second Teacher Workshop

On Tuesday, January 23, 1979, the researchers held the Second Teacher Workshop at the Middle School in Asbury for the teachers in the experimental group. Five of the six participating teachers were present.

The objective of the Workshop was to give the experimental teachers a slide presentation that would generate ideas for unit topics to be presented to students and methods of introducing concepts. The teachers viewed 102 slides with accompanying comments entitled Women at Work: Choice and Challenge Part Two. The slides were designed to convey concepts and information as: (1) education, child care, household management, and leisure time are just some of the areas of life that are being altered by the changing attitudes toward women; (2) society will continue to change as the role of women changes; (3) women have made significant progress in the area of work but have much to gain in the future; (4) having a career often requires that women make tradeoffs in order to make working worthwhile.

The experimental teacher group is very aware of changing attitudes about women's role which have generated career options for women. The group was asked by the researchers to outline a type of Unit Plan they would like to have incorporated in their teaching during the early part of April. The ideas generated were to coincide with the lesson scheduled to be taught at that time. Ideas were discussed with all teachers very involved in the project.

Each teacher was given an outline for discussion developed by the filmstrip makers. The emphasis was to use similar techniques as outlined with the experimental classes. See AppendixGfor discussion questions.

Chapter III

Data on Pre-Testing and Unit Plans

Teacher Control and Experimental Groups' Survey

The experimental teachers in grades 3-8 were compared with the control teachers statistically in the areas of : "Pre-Mathematical Attitudes" (Arlin-Hills Attitudes Survey, "Weighted Occupational Preference" (Both (3), Female (2), and Male (1) and individual preference and choices for "Both","Female", and "Male".

Comparing the two groups, control and experimental, as Show in Table 7, the pre-testing on mathematics attitudes shows that the control teachers in grades 4-7 had a more favorable preference. (Range difference+8 to +31). The eighth grade teacher in the experimental group shows a higher attitudes score (-9). than the control group, and the third grade teachers showed no difference. The norm score was established at 30, and all control teachers were near or above it, while the experimental teachers revealed scores below the norm with two exceptions (sixth and eighth grade - scores 31 and 40, respectively).

As shown in Table 7, the weighted scores for occupational preference indicated that the experimental teachers' scores were close to a perfect score of150. Only the control teacher in the fifth grade had a significatly higher score (144 compared with 80). The individual sex preference for occupations, where teachers checked "Both", "Female", and "Male", re-

vealed that both groups, control and experimental, were of the opinion that most occupations listed in the Survey could be performed by male and female. However, the choice between female and male showed that male was more often chosen. Except for the fifth grade experimental teacher, the scores were relatively low for male and female occupationas preference.

Table 7

Teacher Control and Experimental Groups

Control Grades	Exp. Grades	PreMath Att. #(b) Control	Exp.	Diff.	Weighted Occ. Pref.(c) Control	Exp.	Diff	Occupational Prefer. Control Both	Fem.	Male	Occupational Pref. Exp. Both	Fem	Male
3	3	29	29	0	153	153	0	51	0	0	51	0	0
4	4	31	0	+31	153	153	0	51	0	0	51	0	0
5	5	37	26	+11	144	80	+64	46	1	4	16	7	18
6	6	39	31	+8	127	153	-26	37	2	12	51	0	0
7	7 *(a)	40	27	+13	134	153	-19	41	1	9	51	0	0
8	8 *(a)	31	40	-9	128	146	-18	37	2	11	47	2	3

*(a) Male teachers

#(b) Norm 30-Arlin-Hill Attitude Survey

(c) Weighted: (3)Both, (2) Female, (1) Male

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The Results of Pre-Testing Control and Experimental Groups

Third Grade

The data was grouped for each grade level 3-8 with separate categories for male and female. In the third grade, as indicated by Table 8 , most male and female students were below grade level in their achievement scores. However the majority showed scores above the norm of 25 in the Arlin Hill Attitude Survey. Apparently the students enjoyed mathematics but were not achieving. The occupational preference survey revealed that the female and male students' scores in the control group were higher than those in the experimental group. The overall view is most students are below grade level, interested in mathematics, and with an average or above score on the occupational preference.

Fourth Grade

Table 8 shows that most male and female students in the fourth grade are below grade level in their ability to perform mathematical skills. However, similar to the third grade students, the fourth grades had the majority of students showing an above average interest in mathematics. At the same time, above average scores were recorded for both male and female students in the occupational preference.

Fifth Grade

Unlike the third and fourth graders, the fifth grade control group had a majority of male and female students on grade level or above in their mathematical achievement scores. On the other hand, the students in the experimental group were all below grade level. A pattern similar to grades three and four seems to be appearing. The fifth graders, both male and female, had

scores above the norm in their attitude to mathematics and in the occupational preference survey.

Sixth Grade

The achievement scores for males show that the control group is predominately below grade level while the experimental group is all above grade level. This same pattern is revealed for fifth grade females. Both groups, control and experimental, have the majority of students above the norm of 25 in the mathematics attitude survey. The occupational preference survey also reveals scores in the higher ranges.

Seventh Grade

The seventh graders, male and female, revealed by the achievement test that most were at or above grade level. most students, male and female, showed interest in mathematics above the norm score of 25. Scores for the occupational preference were also in the higher range.

Eighth Grade

Most students in the eighth grade are above grade level in the control group and below grade level in the experimental group. Interest in mathematics in most cases above the norm of 25 for both groups. Scores in the occupational preference survey were also in the higher range.

Summary

An overview of grades three through eight reveals that in the mathematic achievement tests a mixed picture appears, summarized as follows:

3rd grade: majority below grade level
4th grade: majority below grade level
5th grade: control group -majority at or above level
experimental group-all below grade level

6th grade: control group- majority below grade level

7th grade: majority above grade level

8th grade: control group - majority at or above grade level
experimental group - majority below grade level

The data for the Mathematic Attitude and Occupational Preference Survey indicate very clearly that the majority of students have interest in mathematics above the norm score of 25. Moreover, in the occupational survey weighted scores were above average indicating that the students felt "Both" and "Female" could be selected for an occupation listed. However, many occupations were stereotyped for "male only" by both male and female students.

Table 8

Student Mathematical Achievement and Attitude - Occupational Preference

Grade	Sex	Math Achievement #			Math Attitude * #			Occupational Preference		
		Grade	ConNo	ExpNo	Score	ConNo	ExpNo	Score	ConNo	ExpNo
3	M	above3.0	0	1	above25	6	4	150-102	4	3
		below2.9	6	5	below24	0	2	101-51	2	3
								50-0	0	0
	F	above3.0	0	0	above25	5	4	150-102	1	3
		below2.9	6	6	below24	1	2	101-51	5	3
								50-0	0	0
4	M	above4.0	5	2	above25	4	9	150-102	8	10
		below3.9	10	10	below24	2	1	101-51	5	1
								50-0	1	0
	F	above4.0	3	4	above25	7	6	150-102	8	10
		below3.9	7	7	below24	3	4	101-51	1	0
								50-0	0	0
5	M	above5.0	9	0	above25	8	9	150-102	5	3
		below4.9	0	12	below24	1	3	101-51	3	9
								50-0	0	0
	F	above5.0	14	0	above25	11	11	150-102	12	1
		below4.9	2	14		4	3	101-51	4	13
								50-0	0	0
6	M	above6.0	3	14	above25	9	10	150-102	3	3
		below5.9	8	0	below24	2	4	101-51	8	11
								50-0	0	0
	F	above6.0	5	13	above25	11	9	150-102	6	2
		below5.9	10	0	below24	4	4	101-51	9	11
								50-0	0	0

* Weighted Score: Both(3), Female (2), and Male (1).

Arlin-Hills Attitude Survey

Table 8 (cont)

Student Mathematical Achievement and Attitude - Occupational Preference

Grade	Sex	Math Achievement #			Math Attitude #*			Occupational Preference		
		Grade	ConNo	ExpNo	Score	ConNo	ExpNo	Score	ConNo	ExpNo
7	M	above7.0	13	5	above25	12	7	150-102	8	4
		below6.9	2	4	below24	3	2	101-51	7	5
								50-0	0	0
	F	above7.0	7	10	above25	5	15	150-102	8	11
		below6.9	2	6	below24	4	1	101-51	1	5
								50-0	0	0
8	M	above8.0	6	2	above25	9	5	150-102	7	1
		below7.9	4	6	below24	1	3	101-51	3	7
								50-0	0	0
	F	above8.0	8	6	above25	6	9	150-102	11	13
		below7.9	3	7	below24	5	4	101-51	0	0
								50-0		

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* * Weighted Score: Both (3), Female (2), and Male (1).

Arlin-Hills Attitude Survey

Grade Three

Unit Plan On Measurement

by:

Dr. Anne M. Claytor, S.C.

and

Dr. Antoinette J. Messina

Grade Three

Measurement

Rationale:

A. General Objectives
   1. Students will learn to appreciate measurement in their daily lives.
   2. Students will learn to recognize different kinds of measurement and how and when to use each.
   3. Using previous knowledge of time, students will be aware of time sequences and their uses in everyday life.

B. Specific Objectives
   1. Students will learn how and when to use inches, feet, yards and miles.
   2. Students will learn to understand differences between area, mass and volume and how to use each.
   3. Students will learn to distinquish between length and volume.
   4. Students will learn to schedule their days by specific times.

Unit Content

Text: Euholz, Robert E. and O'Daffer, Phares G., Elementary School Mathematics . Menlo Park, Calif. , Addison-Wesley Publishing Company, 1971. Unit 6, pp. 164-184.

Lesson 1:
1. Length introduction (inches, yards, feet, miles)

Lesson 2:
1. Measuring to the nearest inch and half-inch.

Lesson 3:
1. Allocating time.

Lesson 4:
1. Centimeters.

Lesson 5:
1. Area.

Lesson 6:
1. Volume.

Lesson 7:
1. Review.

Materials

Lesson 1:

Filmstrip projector, filmstrip, extension cord, 12 inch rulers (one for each child), 3 yardsticks, a sewing tape measure, pull out metal tape mesure, blackboard, chalk, posterboard (four sheets), wall stapler, staples, magic markers, standard size paper (8X11) for each child.

Lesson 2 and 3:
Ruler for each child, old sheets (or any material measuring at least 26" by 12" for each child), yarn, big safety pins (one for each), pencil (one for each).

Lesson 4:
Filmstrip Projector, filmstrip, extension cord, colored paper, glue.

Lesson 5 :
Ruler with centimeters and inches for each, paper, dittos.

Lesson 6 and 7
Ruler for each child, pencils, yardstick,one piece of paper cut into a perfect square, notebooks for each child, textbook, scarf, newspaper, blackboard for demonstration, teacher's desk for demonstration, placemat, square box.

Lesson 8:
Zerox of pattern of cubes, paints and brushes, glue, wooden cubes (inches or centimeters), scissors.

Lesson 9:
Rice, water, milk and cream containers for cups, pints, quarts, ½ gallons and gallons, lemons, sugar.

Lesson 10:
Recipe (can't double; must make more than one batch) 1½ cups flour , 1 cup salt, 1 tblsp. powdered alum, 1 tblsp. regular oil, 1 cup boiling water, food coloring, large mixing bowl, measuring spoons, measuring cups, wooden spoon, wax paper, centimeter ruler.

Activities

1. Measuring room; height of board.
2. Bookbag
3. Time chart
4. Body and room measurements
5. Finding area of blackboard, desk, notebooks and various objects in the room. Group work.
6. Lemonade; cube-paint sides.
7. Play-dough.

The Relationship to Other Curriculum Areas

1. Reading - understanding instructions and directions.
2. Language - (written)- finding applications at home and recording them.
3. Language - (oral) - ability to express measurement relationships.
4. Language - (spelling) - new vocabulary as needed.
5. Art - making and painting the cube forms, cutting and preparing cloth.

6. Economics - understanding how measurement is used and needed in everyday life.
7. Home Economics - learning simple sewing and basic recipe ideas.
8. Career Education - Understanding that occupations should not be stereotyped.

Lesson Plan 1

Topic: Linear Measurements in the English system

Specific Goals:

1. Students will recognize the importance and use that measurement has in their environment.
2. Students will be familiar with, and be able to use, inches, feet, yards.
3. Students will be proficient in the use of different measuring devices.
4. Given an object to measure, the student will be able to find its dimensions (length and width) in the English system.
5. Given various lengths, students will be able to computate the difference.

Teaching Strategies:

1. Discussion in the introduction
2. Problem Solving

Materials:

Filmstrip projector, filmstrip, extension cord, enough 12 inch rulers for every child, three 3-foot yardsticks, a sewing tape measure, and a pullout metal tape measure, blackboard, chalk, poster-board (4 sheets), wall stapler and staples, magic marker, and a piece of paper for every child (8 X 11).

The Plan:

1. Readiness Activities:
   a. Show a film on development of our measurement system, showing the old ways of measuring such as estimation by size of feet and stretch of arms.
      Before class begins, write on board about five different lines measuring different sizes, such as 7", 2½ feet, etc.
      Staple poster board on one wall with feet and inches marked in magic marker.

Lesson Development:

1. Introduction
   After viewing film, discuss the importance of measurement in our lives. Ask what things we use everday that involve measurement: In out bathrooms? In our kitchens? Other?
   Focus on ideas presented in the movie, such as measurement was invented to develop a uniform set of standards everyone could share, the different types of measurement, linear, volume, time and area. Briefly comment that other parts of the world use the metric system which we will soon be changing to.
   Then introduce the day's lesson which will be on linear type of measurement. Pass out pieces of standard paper and be certain everyone has a ruler.
   Hold up ruler and explain its concepts, such as it has inches and can be divided into half, quarter, and eighth.

Lesson 1 cont.

Demonstrate how to measure by having everyone measure the length and width of their piece of paper. Explain that length is always measured horizontally, and width vertically.

Then hold up a yardstick and point out the fact that it contains all the things a ruler does, but contains feet (which are twelve inches) and is used to measure larger objects.

Also show tape measures and briefly go over the same thing, and the different reasons they would be used instead.

Put on the board the different equivalants: 12 inches = 1 foot, 3 feet = 1 yard

Some questions might be: Look at your rulers and tell me how many inches it has? What does this equal in feet? How many inches in a yardstick? When would it be better to use a yardstick over a ruler?

Then direct the student's attention to the lines on the board (pre-placed). Have one student come up at a time and measure the line and put their results next to it on the board. Have three students involved in each line, one at a time, using a ruler once, the next student using a yardstick and the next a tape measure.

Let students see if the results are the same using the various tools. Explore reasons why or why not each tool is best suited for a particular situation.

2. Break the class into groups of four (five students in each group). Have a predetermined list of objects in the class to be measured such as blackboard , eraser, windowpane, etc.

   Assign two or three objects to each group. Instruct them to measure the length and width of the various objects using any of the tools they choose. Have them write results down so they can report to class. (Teacher proceeds to the different groups to be sure they are measuring right and that everyone is rotating.)

   Then let the groups go to the front of the room and tell what they measured, with what tool, and their results. This will serve as a summary of exact measurements, how to convert inches into feet and yards, the proper use of measuring devices and the advantages of each. Small group participation.

Conclusion:

1. Have students work on workbook, pp. 168-170.
2. While students are doing above, call up the groups that measured one at a time to the poster board. Measure every child and let group see how to get the mixed results in height of feet and inches. Mark each child on the board with their name next to their height. Perhaps let one student measure the teacher so they can compute her height.
3. Later let children examine the poster-board and see the different results. Ask some questions such as; Who is the tallest? Who is the shortest? What is the difference in height in inches. Which two are the closest in height ?

Lesson Plan 2 and 3

Topic: Measurement: A homemade bag.

Specific Goals:

1. Given a ruler, yardstick, material and scissors, the student will be able to measure and cut out a perfect rectangle.
2. Given specific instructions, the students will be capable of measuring out certain amounts of the material on each edge, sew it up and have a finished product measuring exactly 8½ X11½.
3. Students will appreciate the feeling of a job well done and will understand that sewing is not only a woman's job but a man can also perform it.

Teaching Strategies:

1. Step-by step instructions to make a bookbag of exact measurements.

Materials:

Ruler, available to each student; old sheets or any material measureing at least 26" by 12" for each student; yarn; big safety pins (one for each); pencil (one for each).

The Plan:

1. Discussion on measuring to nearest inch, to nearest half inch.
2. Each student takes out his pencil and measures it with ruler. How long is it? Compare student's answers. Emphasize that they are close to what-ever inches.
3. When measuring, sometimes different units are used.We can measure inches, feet, yards, miles. Which do you think would be easier to measure with a foot long ruler. a tree or a crayon? Why a crayon?

   If we wanted to make a bookbag that was 11½ inches long, what kind of measurement would we use?
4. Distribute materials. Be sure each student has a pencil.
5. Explain: We are going to each make a bookbag. First we will measure it and cut it out of the material. Then we will sew it up on the sides and finally we will put a drawstring in the top to close it .
6. The Bookbag:
   a. Measure out the two long sides to equal 12½ inches. Draw a line with a pencil from one side to the other. From that line, measure another 12½ inches. Draw a line there from one side to the other. At the second 12½ inches cut the material along the line.

   The material is now the correct length. Children can measure 9½ inches from top to bottom. Show them how to draw a line at this point all the way across material. Cut on that line.

Lesson 2 and 3 cont.

Children find line they drew at 12½ inches. They fold the material in half along this line. Then they measure exactly one half-inch inward from edge. Draw a line across. This is their sewing line. Do the same on the other side. Now each side should be 12½" high and 9½" long. At the top of the material (open end) measure exactly one inch inward. Draw a line across with pencil. This inch is for a draw string.

(This is a good stopping point for the day.)

Now the children are ready to sew. With yarn in needle, sew the two sides up to the line drawn fro drawstring. Do same on other side (knot yarnat each end.).

Tricky part. Have children fold down the top edge of one side of material one inch (fold at line). They sew edge down making sure that there is adequate space in middle to put drawstring. Do same on other side.

Tie one side of yarn to safety pin. Stick the closed safety pin in opening on one side. Push safety pin all the way through until it comes out the other side, (make sure yarn has stayed inside the open part). Continue with safety pin through opening on other side of material. After safety pin has come out of last opening, remove it from yarn.

Children tie the two ends of the yarn together into a big knot . Turn the bag inside out and it's finished.

Conclusion:

This activity should take a full two days of 30 minutes each to complete. It is an excellent way to have the students use measurement for practical purposes, and also have fun doing it. Have students measure each side of bookbag to the closest half inch. Hand out "dittos" pp. 171, 174, 175, 176 for homework.

Lesson 4

Topic: Measurement in time segments

Specific Goals:

1. Students will begin to grasp the time divisions or time periods in a day.
2. Students will start to realize they can control time, or depend on things happening at a specific time.
3. Students will get a sense of how time is used.
4. Students will observe how different lifestyles affect time spent.
5. Students will observe and account for their personal time.
6. Students will measure conceptually and literally a practical daily routine.
7. Students will measure and make a work/home routine chart.

Teaching Strategies:

1. Discussions using problem questions.
2. Small group experimentation on controlling time. (This lesson plan is based on a scheduling program of large blocks of time and can incorporate mathematics, language arts, drama, creative writing and art.)

Materials:

1. Filmstrip projector, 2. filmstrip 3. extension cord 4. colore paper 5. glue.

The Plan:

1. Readiness
   a. Perhaps during reading period have children read two stories of families with different lifestyles, either due to a location or possibly a family containing children and two parents, and a one parent family.
      Filmstrip "Various Home Lifestyles"

Lesson Development:

1. Discuss filmstrip, explore how time element fits in, perhaps mother works all day so one child prepares dinner, while a child in another family plays until dinner time.
   Perhaps one father works at night so he sleeps during the day, while another father does the opposite.
   Bring into discussion the two stories that were read about the different lifestyles.
      Bring in time element by reviewing that one day contains 24 hours, and A.M. is morning and P.M. is evening.
      Lead a discussion on how the day can be broken up into time segments. Explain the difference between vague time period and exact time periods. Some questions might be for the vague time periods: What are some things you do in the morning? What kinds of things do you do after school?
      Some questions concerning exact time could be: What time did you wake up this morning. When does school start?

Lesson 4 cont.

Discuss advantages of each type. Point out how vague use of time is more conversational, such as "What did you do today?". Precise time is better when having to make appointments or traveling by train.

Use whole group discussion.

2. Have students divide into small groups of three or four. Assign the groups a day of the week - Sunday thru Saturday. Based on a 24 hour day plan, broken into precise time, have them make up an ideal day's schedule, based on all of their experiences or create them. Have students include all activities they would perform during those hour segments.

   This is to prepare students for their assignment of keeping their own work-home charts. This part of the lesson could be developed further by letting each of the groups make a play out of their schedules, with a different scene for parts of the day.

3. After every group has finished their day's schedule, compare them. See how schedules vary depending on the day of the week and the time of the day and the lifestyle of the family.

   Then have students make a chart out of construction paper and glue. (present an example of one) Give them the dimensions they are to make it. Explain that this is to be a personal chart of their own lifestyles. They are to keep a record for the next five days. The chart is for the hours of 8 am to 5 pm and they should complete it daily.

   Have students write on the side of each section on the chart the hours 8;00-9:00, 9:00-10:00 etc.

Lesson 5

Topic: Metric System (especially centimeters)

Specific Goals:
1. Introduction to Metric System.
2. Concentration on centimeter and its relation with the inch.

Teaching Strategies:
1. Discussion of metric system.
2. Measurement of each student and objects in room.

The Plan:
Readiness Activity:
a. Review length in group discussion.

Lesson Development:
1. Using centimeter and inch measuring stick, ask the following questions:
What is this? (ruler)
What kind of ruler? (foot and inch ruler)
What are the measures on the other side for?

This is a centimeter ruler. Each space is a centimeter.
Explain the metric system and where it is used.
Compare centimeter to inch. (2.5 = 1 inch)
Centimeter is part of meter stick. What does the meter stick resemble? Is the yardstick bigger or smaller?

2. The students will be divided into groups of 2 to measure the parts of their body.
   a. First measure with inches.
   b. Then measure with centimeters.
   c. Parts to be measured: thumbs, ring finger, width of palm, shoe, elbow to wrist.
   d. Examine results to determine size difference between centimeters and inches with class discussion.
3. Now in groups of four, measure parts of room.
   a. First with inches.
   b. Next with centimeters.
   c. Parts to be measured: desk top to floor, leg of chair, one floor tile, length of blackboard eraser, width of math book, windowsill width and length.
4. Just as there are smaller units within an inch, there are also smaller units within the centimeter. One of them is called the half centimeter. Teacher draws a rectangle on the board and measures it both with centimeters and half centimeters.
5. Draw an inch ruler on the board.
   Ask the following:

Lesson 5 cont.

a. How many centimeters are in 1 inch?
b. How many ½ inches are in 1 inch?
c. Which is longer- a ½ inch or a centimeter?
d. How many inches are there in 10 centimeters? 4
e. How many inches are there in 20 centimeters? 8
f. How many centimeters are there in 6 inches? 15
g. How many centimeters are there in 2 inches? 5

Participation:

1. Discussion - entire class.
2. Small groups for measuring.

Conclusion:

Take home 2 dittos on metric and centimeters pp. 172-173.

Lessons 6 and 7

Topic: Area

Specific Goals:

1. Given the formula L X W, the students should be able to find the the area of a flat surface.
2. Students will understand the meaning of "square inch".
3. They will be able to solve problems using their measuring skills.
4. Students will learn to work with their peers in problem solving.

Teaching Strategies:

1. Guidance in measuring to find area through teacher instruction.
2. Group work to utilize the instruction.

Materials:

Ruler, pencils, yardstick, 1 piece of paper cut into a perfect square, notebooks for each child, textbook, scarf, newspaper, chalkboard for demonstration, teacher's desk for demonstration, placemat, square box.

The Plan:

1. Have the children measure the length of their notebooks, and have them write it down. Then, instruct them to measure the width, or how far across the notebook is. Is your notebook a square, a triangle, or a rectangle?
2. How would we find out how much space the notebook occupies? What could we do to find out? What do we call the space within the edges of your notebooks? The space inside is called the area. To find the area, we simply measure the length; then we measure the width, then we multiply our two answers. Write on the board: Area = LxW. Ask the students to find the area of their notebooks and to share their responses with the class.
3. Using the yardstick, let the students try to find the area of the top of the teacher's desk. Have two or three students measure the desk. Ask one to write onthe board the findings and have the class give the final answer. Find out if the class has any questions about anything that was just said or done and clear up any difficulties.

(This is a good place to break)

Second Day:

1. Break the class into groups of four or five students. Set up stations around the room. At station number one, place a textbook and a newspaper. At station number two, place a place-mat and a scarf. At station three, put a square box, and at station four a piece of square paper.

2. Instruct the children as teams to go to the different stations, one team at a time; each team at a different station and find the area of those objects. Allow fifteen minutes for this. Remind them that to find the area they are working with a flat surface and must measure the sides of that surface. Explain to them that if those in the group cannot figure something out, not to panic, but to move on to the next station.

3. When the fifteen minutes or so has passed, ask them to return to their seats in groups and ask that one person from each group report the findings and discuss these with the entire class.

4. Take special care to mention that the area of a figure or object in which all four sides are equal is known as square inches, or square centimeters,square yards or whatever the unit of measurement may be. Suppose the square paper used at station four was four inches all around, demonstrate to them that this is referred to as 16 square inches.

5. Homework assignment: p. 178, 179, 180 and 181

Lesson 8

Topic: Finding Volume

Specific Goals:

1. Given a pattern of a cube, the students will be able to identify and count the squares in a cube pattern.
2. Given the pattern of a cube, the students will be able to glue it together to form a cube.
3. Given the finished cube, the students will be able to identify the number of squares on the surface of the cube.
4. Given wooden cubes (in inches and centimeters), the children will be able to experiment, build structures with the cubes, and count the number of cubes with and without moving the cubes.

Materials:

Patterns of cubes, paints and brushes, glue, wooden cubes (inches and centimeters), scissors.

The Plan:

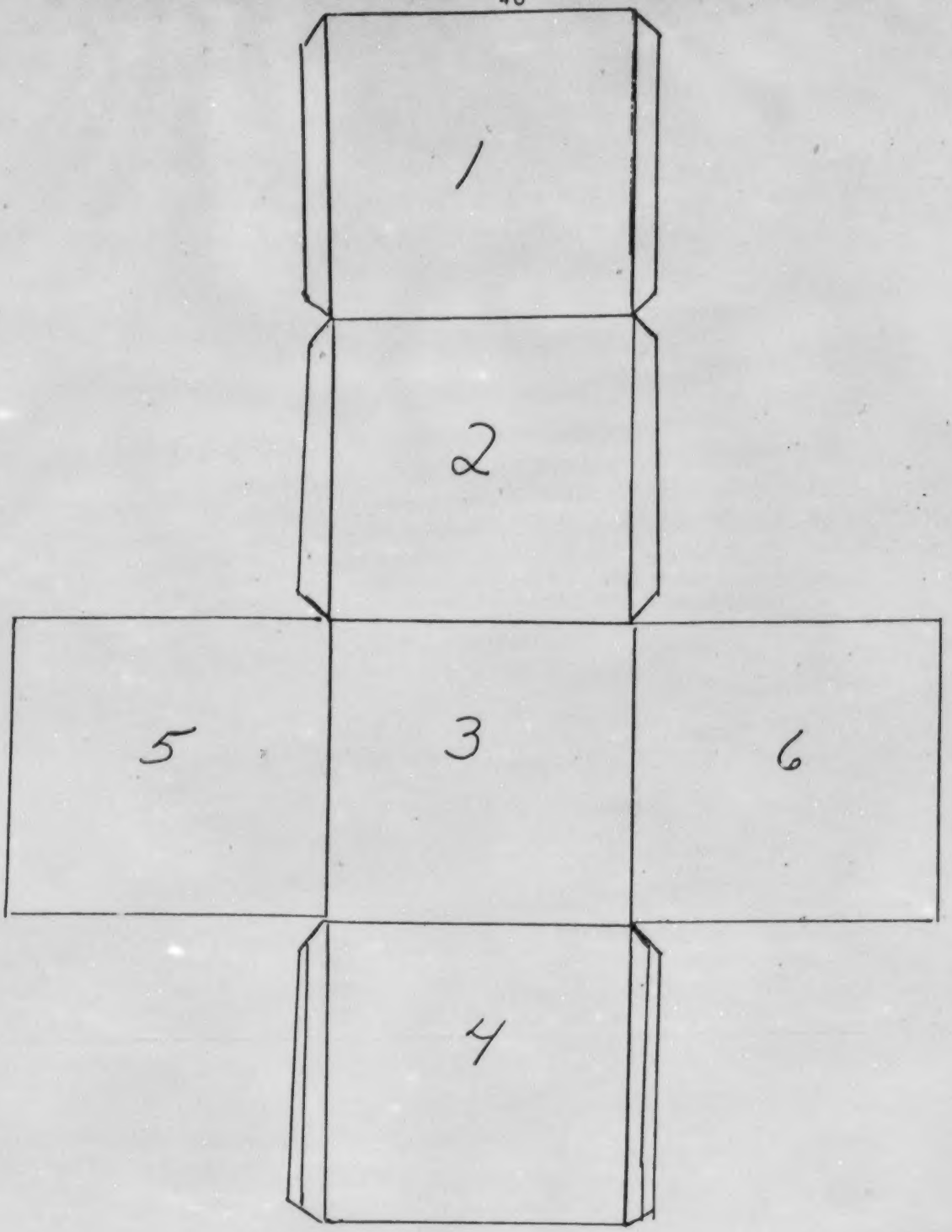
1. Give the children the patterns of cubes. Have them put the cubes together (with help if necessary). Directions: Fold pieces 5 and 6 up, glue four flapsto the 5 and 6 sides. Fold up and glue to the 5 and 6 side. Fold 1 to the 5 and 6 side on the top. Then have the children paint each side so they can differentiate between the sides.
2. How many sides does the cube have? Could you count the sides if all the cubes were stacked together? If the sides measure two inches, what do you think all of the sides measure together? Could you use area to measure the cube?

Lesson Development:

1. First step - Get the Wooden cubes. Compare them to the cubes that you just made. Do they have the same number of sides. Could you use area for these cubes? Why? Why not? How would you measure the space inside? These are called cubic units. Can you figure out why?
2. Second Step - This type of cubic measurement is called volume. Stack the wooden cubes together in a square of four blocks. Count the units. Stack the units in larger groups. Can you count the units? Can you count them without moving any blocks? If not, why not? Could you use multiplication to help you? Try to make irregular stacks. Count the cubes. Try to count (preferably not by a single cube)the number of sides of the cubes. How did you do it? Will this method always work?

Conclusion:

1. Do you see any cubes or groups of cubes in the classroom? Do they all have the same number of sides? Find a number of classroom objects and try to think of how you would measure them.
2. Do pages 182-183 for homework. Make a list of the cubes you find in your home.


1
2
5
3
6
4

Lesson 9

Topic: Liquid Measurement

Specific Goals:

1. Given cream, milk and other containers of ounces, cups, pints, quarts, half gallons and gallons, students will discover by pouring water or rice from one container to another, what containers are smaller than or larger than other container.
2. Given the same containers, the students will derive equality measurement (i.e. pint = 2 cups, et.)
3. Given a small container, the students will be able to reduce a recipe of lemonade to fit the container.
4. Given a large container, the students will increase a recipe of lemonade to fit the container.

Materials:

Rice, water, containers for all of the units, lemons, sugar.

The Plan:

1. Introduction:
   Have the students take their containers and experiment with rice or water. Have them pour from one container to another to find their own measurement equalities and inequalities.
2. Motivation: What have you discovered? Can you name what units are equal to two parts of another unit? How many of the smallest unit will fit tinto the largest unit? If you wanted a coke, which unit would you ask to have it in?

Lesson Development:

1. First step. Find all of the units which are equal to two parts of another. Try to guess what the combination of all your units would total. Divide a gallon and a half gallon as many ways as you can. Do you see a pattern?
2. Second step: lemonade. Students are given a small container (2 cups) give them the following recipe for lemonade: 4 quarts water, 4 cups sugar, 12 lemons. Have them change the recipe to fit their container. Then have them taste the results to see if they are correct. Then divide the class into two or three large groups. Give each group a large container and the following ingredients: 3 lemons, 1 cup sugar, 1 quart water. Taste the results.
3. Ask the students if they would rather have the lemonade in a tall,thin container or a short fat container of the same volume.

Conclusion:

1. How much more would you need to fill a gallon jug after you have poured 2 quarts, 8 ounces?
2. Take your findings from your lemonade recipe and make a recipe for 2, 6 and 8 people.
3. Do p. 184. If you can find a liquid recipe and make it for your family.

Lesson 9

4. Homework: Ask parents and family friends how they use measurements (liquids and solids) in their occupations and everyday life. Write a list for next day's discussion.

Lesson 10

Topic: The use of measurements (liquids and solids) in occupations and everyday life situations.

Specific Goals:

1. The students will relate the use of measurements to their everyday life, as well as the life of their parents and friends.

Teaching Strategies:

1. Discussion on occupations and measurements.
2. Role playing performed by the students to show how measurement is used in different occupations.

Materials:

Rulers, yard sticks.

Readiness Activities:

Review of the use of measurement

Lesson development:

1. Quiz on measurement.
2. Ask parents and family friends how they use measurement in their daily lives.
3. Text and workbook.

Participation:

1. Group discussion on homework and problems in class.

Conclusion:

Have the students discuss how they, their parents and friends use measurement in their lives.

Grade Four

Unit Plan

on

Addition and Subtraction of Like Fractions

by

Dr. Anne M. Claytor, S.C

Dr. Antoinette J. Messina

Fourth Grade

Addition and Subtraction of Like Fractions

1. Rationale
   A. General Objectives
      1. The students will be able to add and subtract fractions with common denominators.
      2. The students will be able to apply fractions to everyday life.
      3. The students will be able to recognize the use of fractions in career development and stereotyping.

   B. Specific Objectives
      1. The students will be able to problem solve.
      2. The students will understand and be able to relate to different occupational skills that rely on the use of fractions.
      3. The students, through the use of the fraction kit, will come to understand the idea behind eqivalence of fractions.
      4. The students, will be able to replace fraction groups with others, for example: 1/8 = 1/16 + 1/16.
      5. The students will learn while participating in the "Employment Agency" activity that mathematics skills are used by both men and women in various occupations.

Unit Content

Text: Duncan, Ernest R.,(Coordinating Author).Mathematics . Boston, Mass., Houghton Mifflin Company, 1978.

Lesson 1.
Introduction - Role Playing

Lesson 2
Addition of Fractions

Lesson 3
Addition of Fractions - Cover-Up Game

Lesson 4
Review and Quiz

Lesson 5
Introduction to Subtraction - Bonus Problem Solving

Lesson 6
Subtraction of Fractions on a Number Line

Lesson 7
Word Problems

Lesson 8
Greater Than and Less Than with fractional numbers - color wheel

Lesson 9
Culminating Activity - At the Employment Agency

Lesson 10.
Evaluation - Fraction - Infraction

Materials

Strips of colored paper, bag or box of small paper squares with one digit numbers, paper cutter, scissors, number line dittos, crayons, paper, pencils, cardboard clock with paper overlays, scale, pre-weighed items, measuring cup, yard stick, masking tape, pre-cut black circle, colored paper with pre-drawn fractional parts.

Activities

1. Role playing
2. Work with concrete idea in textbook
3. Making fraction kit - "cover up game"
4. Uncle Bill's Letter
5. Substitution of fraction problems using shapes. Bonus problem solving
6. Work with number line.
7. Children do worksheets and make up their own word problems.
8. Color wheel work.
9. At the employment agency.
10. Children make equipment for and learn how to play "fraction infraction"

Relationship to Other Curriculum Areas

Lesson 1 - Other forms of math - measurement. Learning about careers.
Lesson 2 - Cooperative game playing
Lesson 3. - art
Lesson 4 - Language arts, science, spelling
Lesson 5 - Art
Lesson 6 - Language arts, problem solving techniques.
Lesson 7 - Reading and listening skills
Lesson 8 - Art
Lesson 10 -Language arts, cooperative game playing

Participation

1. Whole class for instruction and discussion
2. Individual work for the food list activity
3. Whole class for the closing discussion.

Lesson 1

Topic: Fractions in everyday life.

Specific Goals:

1. The children will realize the use of fractions as they occur in everyday life and in specific careers.

Teaching Strategies:

1. Role playing
2. Teacher directs questions to the children.

Materials:

1. Cardboard clock with construction paper overlays indicating 1/8, 1/4, 1/2, 1/3, 1/5, 3/4.
2. Cardbaord pizzas or pies.
3. Scale with ¼ and ½ markings.
4. Pre-weighed items to use with the scale.
5. Measuring cup
6. Yard stick
7. Chalk or masking tape
8. Construction paper
9. Crayons

The Plan:

Readiness activity: One use of fractions in everyday life. Since the students have learned measurement in the 3rd grade, begin the fraction unit with measuring. This will progress into the role playing which emphasizes the use of fractions in a variety of careers.

Have the students work in pairs to measure each other's height. Mark with a line on the board or with masking tape on the walls. Note the children who have to use fractions in the measurement of their height. Record the information.

Lesson Development:

1. Role playing for fractions in careers.
   Have the students act out different career roles which require the use of fractions, e.g.
   1. a pizza maker
   2. a butcher/ meat cutter/ deli clerk
   3. a baker
   4. a doctor/ nurse

   Ask the students, given a profession, how would that person use fractions? The students should be free to choose items listed under "materials" to use in their acting out of careers.
2. Have the students suggest other careers that utilize fractions.
3. Seatwork: Students could draw pictures depicting people using fractions in their career.

Participation:

1. Pairs for readiness activity
2. Entire class for lesson development, 1 and 2
3. Individuals for lesson development, 3

Lesson 1 cont.

Conclusion:

The teacher demonstrates the fractions which can be seen on the face of a clock. Use the cardboard clock with the paper overlays which indicate the following:

15 minutes = ¼ hour
30 minutes + ½ hour
45 minutes = 3/4 hour
60 minutes = 4/4 hour or one hour

Lesson 2

Topic: Introduction to addition of like fractions.

Specific Goals:

1. Students will be able to add like fractions.
2. Students will have enjoyed a math experience.
3. Students will value being part of a team. The team members will assist one another and there will be no losers. Success yields positive attitudes toward learning.

Teaching Strategies:

1. Discussion
2. Board work
3. Game
4. Textbook

Materials:

Colored paper, textbook

The Plan:

1. Readiness Activities:
   a. Discussion
   b. Review of concepts

Lesson Development:

1. In adding like fractions, it is the numerator, the top part of the fraction, which increases in value. The denominator, the bottom part of the fraction, remains the same.

   Recall: The numerator stands for a part of the whole number. The denominator stands for the whole number. Two like fractions, when added, will show a greater numerator, while the denominator stands unchanged; ¼ + ¼ = 2/4

   Chalkboard Demonstration :

   $\frac{1}{4} + \frac{1}{4} = \frac{1 + 1}{4} = 2/4$ The two numerators are added.

   The answer shows the addition of the two numerators, while the denominator remains unchanged.
   Do several to demonstrate taking examples from textbooks.

2. Divide the class into groups.
   Each group will consist of four pupils.
   Give each group a sheet of paper.
   Each group will:
   be given a number of problems to solve.
   will solve the following:
   Four sets of fractions, each set to consist of two fractions. pp. 289, 294 in text.
   will solve one set at a time. The score will be place on the board.
   will work together to solve each set.
   Each student will write his equation on the board. This enables the teacher to evaluate the students' comprehension.

Lesson 2 cont.

Participation:
Whole class discussion.
Small groups for game.
Individuals for board work.

Conclusion:
Summarize the blackboard demonstration: $\frac{3}{8} + \frac{4}{8} = \frac{3+4}{8} = \frac{7}{8}$

Adding like fractions means adding the numerators.
The denominator remains unchanged.

Assignment: Textbook, p. 288, #1-12.

Lesson 3

Topic: Addition of fractions with common denominators and the understanding and use of equivalence in fractions.

Specific Goals:

1. The students will increase their understanding of the addition of fractions method.
2. They will understand that addition takes place in the numerator.
3. They will be able to see the relationship that exists between fractions.

Teaching Strategies:

1. Hands on Activity
2. Discussion
3. Group work - playing games.

Materials:

1. 5 strips of colored construction paper for each student
2. Scissors
3. Fraction cubes

The Plan.

1. Readiness Activities:
   a. Review the idea of "what is a fraction" as discussed in the introduction to addition of fractions lesson. Bring out again that fractions are parts of a whole. Be sure each child understands what is meant by the terms numerator and denominator.

Lesson Development:

1. Give each student 5-3x18 inch strips of colored paper. Each child gets one strip of each color.
2. Tell the students which colored strip they will be working with first, second, etc.In this way each child will have the same fraction kit.
3. Tell each student to take the red strip of paper and lay it out in front of them on their desk. Tell them to notice that it is an uncut strip. It is one complete strip. Ask them to give you another word for complete, i.e. whole.
4. Instruct them to take their yellow strip of paper and fold it into 2 pieces and then cut. Label each piecel/2.
5. Ask how many pieces have you cut the whole into? Explain that there are 2 strips of paper and that each one strip is 1 part of the two pieces(1/2). Have them lay the 2 pieces of yellow paper beneath the whole red strip. Ask them to describe to you what they have done; i.e. they have cut the whole into 2 equal parts. Each piece is 1 part of the whole. Write on the board a numerical problem describing what they have done. $\frac{1}{2} + \frac{1}{2} = 1$ What is larger? The piece of paper labeled $\frac{1}{2}$ or the strip labeled 1.
6. Repeat the process using $\frac{1}{4}$, 1/8, 1/16. Assigning a different color paper with each new fraction. Repeat the same type

questions using the "whole" strip and the strips that came before the one they are presently working with. How many pieces labeled ¼ does it take to make or fillup a strip labeled½? The students will see that they can place four ¼ strips on the whole strip and two ¼ strips on the half ½ strip. Continue. Ask the students to come to the board and write out a numerical problem representing what they have done.
(¼ + ¼ = 2/4) (¼ + ¼ fill up 1/2)(¼+¼+¼+¼ = 4/4 = 1)

6. Discuss with the class the things they have just completed. Discuss the idea the 1/16 is less than 1/8 because (as they can visually see) it takes two 1/16 blocks to fill up one 1/8 strip. Etc.

Participation:
The lesson will involve the entire class.

Lesson 4

Topic: Review of addition of fractions and take-home quiz.

Specific Goals:

1. Students will be able to use the number line to add fractions.
2. Students will be able, with the assistance of the teacher, to apply elementary word problems in writing fractional names for parts of a set.
3. Students will be able to identify when the numerator and denominator are the same then the fraction is equivalent to the whole number one.
4. Students will become acquainted with occupations and relate them to mathematics.

Teaching Strategies:

1. Class discussion
2. Class experimentation
3. Class demonstration

Materials:

Number line, "ditto" quiz, dictionary, animal pictures, chalk, chalkboard.

The Plan:

1. Readiness Activities:
   a. Before actual lesson, review on classroom numberline, addition of whole number.
   b. Stress importance of reading words carefully.
   c. Have students discuss occupations they are aware of and teacher may expand list.

Lesson Development:

1. Analysis of previous unit experiences.
   a. Discuss number line with the class. Make sure that they understand 5/8 of one whole space is being added to 2/8 of one whole.

   b. Develop number line showing 3/10 + 7/10 and 1/6 + 4/6 in the same way.
2. Extending Unit concepts to related problems.
   a. Students are to write fractions relating them to a concret use for parts of set described.
      1. Work with students in completing exercise 1 and writing the fractions for exercises 2a and 2b/
      2. Have students observethat the answer to exercise one gives denominator for fractions in exercise 2, and that denominator for three and four will be different because sets of animals are different.
3. Review quiz.
   a. Hand out "ditto" and have children work independently in obtaining answers.

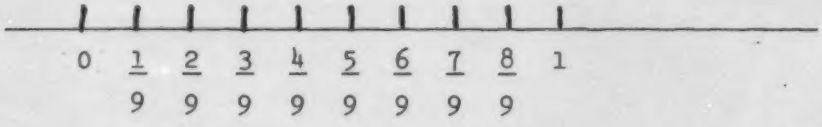
Lesson 4 cont.

Participation:
1. Entire class for discussion.
2. Individual work.

Conclusion:
1. Finish take home quiz for homework.

Take Home Quiz

1. Write the addition sentence for this number line.



2. Copy and write the missing number:

1/4 + 2/4 =	1/2 + 1/2 =	3/9 + 5/9=
2/10 + 3/10 =	1/7 + 3/7 =	2/4 + 2/4 =
4/12 + 3/12=	4/10 + 5/10 =	4/7 + 1/7 =

3. What fraction names part of region shaded?

4. What fraction names entire region?

5. Since 4/4 and 1 both name the entire region, does 4/4 = 1?

Lesson Plan 5

Topic: Introduction to subtraction of fractions with common denominator.

Specific Goals:

1. As a by-product of concrete examples, the students will be able to subtract one fraction from another with a common denominator.

Teaching Strategies:

1. Discussion
2. Follow-up discussion
3. End of day activity

Materials:

Paper, crayons.

The Plan:

1. Readiness activities:
   a. Review with the children the concept of fractions - numerator and denominator.
   b. Review that addition occurs in the numerator when denominators are equal (as taught in addition of fraction lesson).

Lesson Development:

1. Pass out paper to each student. Have students draw four circles, each divided in a way that corresponds with the division on the "pies" on the teacher's example. For example, divisions could be sixths, halves, eights and quarters.

2. Have students color in for example, 2/6 of the first circle. Teacher then does this on the chalk board by coloring in two of the six pieces of one of the "pies". Ask students how many sections are left?
3. Have students write the subtraction equation they just drew on their papers. After this is completed, the teacher writes it on the board (6/6 - 2/6 = 4/6) and asks the students to check their answers againsthers. Have the students explain why this answer is right.
4. Repeat with other circles (or pies). Remember to begin some problems with partial fractions (ex. 3/4 - 1/4). Ask the students where subtraction occurs - in the numerator or denominator? Ask them what they notice about the denominator in these cases - are they equal or unequal? Be sure students understand that the denominator is the total number of pieces and that the numerator is how many you are removing and how many you have left.

Participation:

Entire class

Conclusion- Follow-up Activities:

Have the students bring home some paper and create their own problems, using any shape and including the number sentence.

Before the students go home for the day, try this activity as a reinforcement.

1. Have someone count how many children are in class.

2. Ask the students what part of the 23 are girls? What fraction would that be? Write it on the board.

3. Ask for that particular fraction to line up at the door.

What are we subtracting? Write it on the board.

4. For a bonus, have the students bring the problem home and solve it, and explain what the answer represents. X represents the number of boys in the class.

This can be done as an ongoing game for the remainder of the unit, switching categories each day (ex. how many blondes, how many are wearing red, etc.)

Students with correct answers could receive a " Freddie Fraction Certificate of Merit".

Lesson 6

Topic: Subtraction of fractions on number line.

Specific Goals:

1. Students will be able to use number line to subtract like fractions.
2. Students will see how fractions are applied to our daily lives.
3. Students will appreciate problem solving techniques.

Teaching Strategies:

1. Discussion
2. Boardwork
3. Textbook
4. Problem Solving

Materials:

1. Number line
2. Paper
3. Text p. 291

The Plan:

1. Readiness Activities:
   a. Discussion: why, who, what

Lesson Development:

1. Why do we need fraction?
   Who uses fractions?
   What does take away mean?
   What does less than mean?
   Do we subtract fraction when we cook? Don't we use a fraction of the milk,butter, etc?
   Do teachers subtract fractions when they give out paper, etc.?
   Doesn'teach child have a fraction of the paper?
   Do yousubtract fractions when you give your friend half of your cookie? How much of your cookie do you have left?

2. Use the number line to subtract like fractions.
   Reminder: When we subtract, we move to the left.
   We've used the number line to subtract whole numbers.
   Fractions are parts of whole numbers and they are represented on the number line. Find 4/8, etc.

   We subtracted whole number, i.e. 8 - 5, we started at the number 8 and moved 5 numbers to our left. We use the number line in the same way to subtract like fractions. Start at 6/8, now subtract 2/8. We move 2/8 to our left and see that the answer is 4/8.

3. Use textbook p. 291, exercise # 1-7.
   First read over top of page: Subtract Fractional Number.

   The blue arrow shows the subtraction 5/8 - 3/8 = 2/8.
   Before the students begin, ask if everyone understands how to use the number line to subtract like fractions. Point out that the denominator stays the same. They are filling in the answer for the numerator. When work is completed, collect

Lesson 6 cont.

for evaluation. Teacher will work with individuals who need assistance.

Participation:

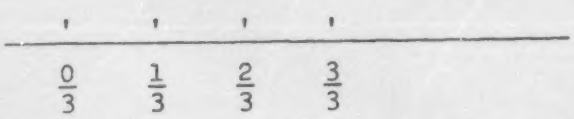
Class discussion
Individual work in text.

Conclusion:

Summarize with a blackboard demonstration of what has been done. It is the numerator that shows the subtraction. The denominator stands unchanged.

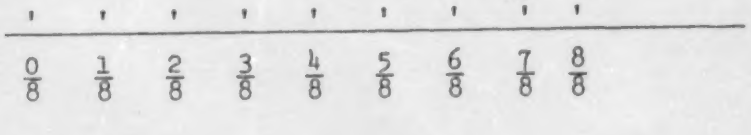
Assignment to do at home:

1. If John takes 1/3 of Mary's sandwich, how much of the sandwich does Mary have left? Mary's sandwich = 3/3. (Reminder: 3/3 = 1 =



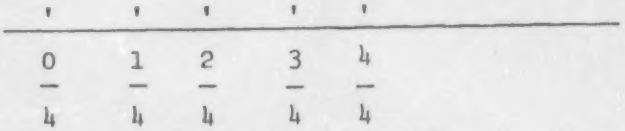
2/ If Bob has 6/8 of his work completed, how much of his work does he have left? The total amount of Bob's work = 8/8. We must subtract 6/8 from 8/8 in order to get an answer. Therefore:

$\frac{8}{8} - \frac{6}{8} =$



3. If I need 1/4 of the class to paint a mural, how much of the class will be left to make the scenary. The whole class = 4/4. We must subtract 1/4 from 4/4 in order to know how much of the class will be left to do the work of making the scenary. Therefore:

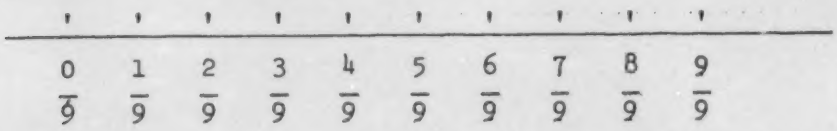
$\frac{4}{4} - \frac{1}{4} =$



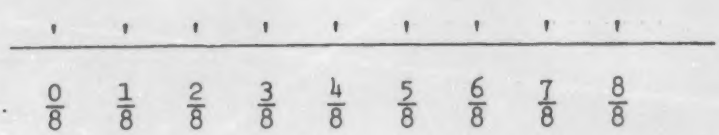
From now on we give three word problems similar to the above, but without the step-by-step instructions.

Lesson 6 cont.

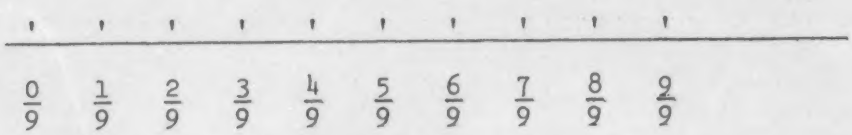
4. If Bill takes 5/9 of John's baseball cards, how many cards does John have left? Remember 9/9=all of John's cards.



5 If Diana has 7/8 of the dishes washed, how much does she have left to wash?



6. If I need 8/9 of the class to collect milk money, how much of the class is leftto collect picture money?



Lesson 7

Topic: Word problems using addition and subtraction of like fractions.

Specific Goals:

1. The students will be able to see once again that fractions are useful in their everyday lives.
2. They will be able to work with the addition and subtraction of like fractions methods simultaneously.
3. They will be able to interpret words into numerical sentence statements.

Teaching Strategies:

1. Visual demonstration
2. Discussion - verbalization of problems
3. Ditto- individuals working alone
4. Partner work

Materials:

Visual aid, variety of problems available and "dittos".

The Plan:

1. Readiness Activities:
   a. Discuss with the students the ways in which fractions enter into their lives through out the day. For example: when they go to the store they use parts of a dollar to pay. When they help their mothers bake, they must understand fractional concepts in order to follow directions and work with a measuring cup, etc. A short "ditto" sheet would be appropriate at this time to insure that the students can work out both addition and subtraction of fraction problems.

Lesson Development:

1. As the teacher, give the class a visual representation of how to solve a word problem.
   First read the problem to the class. Follow with visual representation at the board.

2. Take your pie pieces (have available sections of 6, 5, 4, 3, for variation) and put them up. Read sample problem: Mrs. Smith has 4 sons. She has just baked a pie and cut it into 5 equal parts. If each son takes a piece of pie, how many pieces will she have left?

   $$5/5 - 4/5 = 1/5$$

   Tell the students to write out a numerical sentence that represents the problem you have just read.

3. For concrete representation, remove the 4 pieces of pie and let the children see how many are left.

Lesson 7 cont.

4. Do this type of problem again (for as many times as needed) using different fractional parts and different situations.

5. Now move to verbal work problems without visual representation. This can be done by asking students in the class word problems that pertain to them. Example, Ask the students how many people in the class like pizza better than hot dogs. What part of the classlikes hot dogs better? This type of verbalization of problems can be repeated as long as needed.

6. Next step would be to move to interpretation of written word problems. Practice problems are effective in becoming proficient. Have the student complete this problem sheet in class without any assistance unless it is requested.

Sample problems:

1. John put up two shelves in his workshop. One shelf was 2/7 feet long, the other shelf 3/7 feet long. How many feet of lumber did he need to make the shelf? If he bought 6/7 feet of lumber, how much lumber would be left over?

2. Mary had a piece of ribbon that was 3/6 inches long. If she cut 1/6 inch off, how much ribbon would she have left? If her mother bought her 2/6 more inches of ribbon how many inches would she have.?

Participation:

Lesson begins with entire class participation followed by individual student work.
When role playing is used, the students will work in two's.

Conclusion:

Follow-up activities:

1. Have the students make up fraction word problems on their own for homework. Teacher assigns the fraction denominators to be used and the method (subtraction, addition, both) each student is to use when making up the word problems.

Lesson 8

Topic: Comparison of fractional numbers: greater than, less than, equal to.

Specific Goals:

1. The students will realize the concepts of greater than, less than, equal to. as they apply to fractions.
2. The students will be able to apply these concepts in comparing fractions.

Teaching Strategies:

1. Students doing
2. Questions and actions

Materials:

1. Colored paper pie
2. Scissors for the class.
3. Colored paper with pre-drawn fractional parts
4. Pre cut black circle for the paper pie
5. Homework "ditto"

Readiness Activity:

1. Students are to cut out the predrawn fractional pie parts in order to make their own pies.

Lesson Development:

1. Review the greater than, less than, and equal to symbols.
   a. What is another word in mathematics which means bigger or larger than?
   b. What is another word in mathematics which means smaller than?
   c. What is the word which we use in mathematics when two things are the same?
2. Ask the students to show various fractional parts by using their colored fraction pies.
3. Ask the students to overlap various fractional parts while asking "Which fraction is (greater than), (less than), (equal).
   Do this activity with the students and after they arrange their pies and answer, show them your pie so that they may correct theirs if necessary. Observe the students that apparently are having difficulty with this concept, and correct the problem.
4. Summarize the concepts:
   Write several comparisions on the board and have the students complete them. The students can check each other's answers using their own pies.
5. Homework: Reinforce the concepts with similar problems.

Participation:

Entire class.

Conclusion:

This lesson ends the teaching aspect of the unit, The culminating activity and the evaluation follow.

Lesson 9

Topic: At the employment agency

Specific Goals:

1. Students will be able to see the use of fractions in all walks of life.
2. Students will gain a better knowledge of what is offered in occupational opportunities.
3. Students will overcome sex-role stereotyping in occupational choices through the use of the displays.
4. The student's math anxiety will decrease.

Teaching Strategies:

1. Discussion
2. Display
3. Discussion

Materials:

Cardboard boxes used as backboards
construction paper
tape
occupational pictures
measuring cup, measuring spoon
needle
each display will have materials that coincide with the exhibit

The Plan:

1. Readiness Activities:
   a. A discussion of the use of fractions in the world of work. Relating why we learn how to use fractions.

Lesson Development:

1. The entire lessonwill consist of a learning center focusing in on the job opportunities and how each occupation makes some use of fractions. See diagram.
2. A discussion of what the class learned and how they feel about their future will conclude this lesson. Include in this discussion areas that were not in the display but the students feel use fractions.

Participation:

1. Total class participation in opening discussion
2. Small groups traveling from one occupational area to the other.
3. Total group discussion as concluding activity.

Conclusion:

Have students for homework write a short essay on an occupation. Have them include how the occupation uses fractions.

AT THE EMPLOYMENT AGENCY

Home Econ.
Cooking
Sewing
Nutrition

Scientist
Chemical formulas
Beakers
Graduate cylinder

Postal clerk
Weighing letters
Postage weights

Music and Art
Notes
Time signature
Lines
Perspective

Doctor
Prescriptions
Scale
Needles

Lawyer
Survey results
Stat. Predictions
of winning

Engineer
Formulas
Measuring
Drafting

Craftsman
Measuring
Drafting
Mechanical
drawing

Math
Teacher
Statistician
Computer

Business
Budget
Inventories
Taxes

In Each Display:
1. Non-stereotyped pictures of persons in occupation
2. Nature of occupation
3. How occupation related to fractions.
4. Name and address for additonal information

Lesson 10

Topic: Fraction-infraction culminating activity and evaluation

Specific Goals:

1. To determine whether the class as a whole understands addition and subtraction of fractions, and to give the students an enjoyable review of the processes.

Teaching strategies:

Discussion, explanation
Activity (problems)
Discussion of game
Game

Materials:

3 x 5 notecards
bag or box of small paper squares, with a one digit number written on each
paper and pencils

The Plan:

1. Readiness activities
   a. Explain that now that we know how to add and subtract fractions, we're going to play a game using those skills. Explain (or have students look up in a dictionary) the meaning of "infraction" as the breaking of rules.

Lesson Development:

1. Divide the students into groups of no more than four students. Give each group member four notecards, on which he will write two addition and two subtraction problems, using the denominator you assign the group. Have the students put the solution on the back of the card.
2. Collect the cards and check them, making note of which students appear to be having difficulties. Add some teacher made cards with different denominators to the students' cards.
3. Give the corrected cards, shuffled, back to the groups, along with a bag or box of the paper squares with one digit numbers. Pass out scrap paper to each student.
4. Introduce the game "Fraction-Infraction". The first group member chooses a one digit number from the bag and a problem card. He then attempts to solve the problem. If the solution is correct and does not include the one digit number he picked out of the bag, the player gets one point. If the one digit number appears in either the numerator or the denominator, he loses one point. He may continue playing after winning one point or pass play onto the next group member.

Lesson 10 cont.

5. However, if the student solves the problem incorrectly, the first student to see the mistake says "Fraction-Infraction'." He then may solve the problem correctly and receive ½ point. If he solves it incorrectly, he loses ½ point.
6. The game is played until someone reaches 7 points and a winner is declared. Students are not only performing the addition and subtraction problems on the cards, but they must also add and subtract ½ point periodically from their scores. The teacher can sit in on each group and observe individual progress as well as group interaction.

Participation:

Small groups.

Conclusion - Followup Activities:

"Fraction-Infraction" cards and aquares can be placed at the math center for use by students. Encourage the students to continue making new problem cards. As additional evaluation, have worksheets available at the math center, which students complete to give the teacher another basis for evaluation and to receive some small prize or a "Freddie Fraction Certificate of Merit".

Grade Five

Unit Plan

on

Addition and Subtraction of Fractions

By:

Dr. Anne M. Claytor, S.C.

and

Dr. Antoinette J. Messina

Grade Five

Addition and Subtraction of Fractions

1. Rationale:
   A. General Objectives:
      1. The students will be able to add and subtract fractions and understand the vocabulary and notation.
      2. The students will be able to recognize the relationship of a fractional part to its whole.
      3. The students will be able to apply fractional concepts to daily living through word problems and career observations without stereotyping.

   b. Specific objectives:
      1. The students will be able to simplify fractions.
      2. The students will be able to add and subtract with fractions with like denominators.
      3. The students will be able to add and subtract fractions with unlike denominators.
      4. The students will be able to solve word problems using addition and subtraction of fractions.
      5. The students will be able to convert mixed numbers into fractions.
      6. For each of the above mathematical operations the students will be able to apply their knowledge of fractions to:
         homelife situations
         occupations of daily living
         careers they may seek in later life.

Unit Content

ext: Duncan, Ernest R. (Coordinating Author) Mathematics. Boston, Mass., Houghton Mifflin Company, 1978.

Lesson 1.
Importance of fractions.

Lesson 2.
Formations of fractions.

Lesson 3.
Relations of fractions to a whole.

Lesson 4.
Simplification of fractions.

Lesson 5.
Word Problems.

Lesson 6.
Conversion of fractions into whole numbers so they can be used for daily living.

Lesson 7
Discussion of occupations that the students know which use fractions on the job.

Lesson 8
Discussion of how both sexes can do these jobs.

Materials

1. Magazines, scissors, paste.
2. Lima beans, measuring cup, needle, yardstick, masking tape, ruler.
3. Paper plates, crayons.
4. Egg cartons, marbles.
5. Construction paper, hooks, board.
6. Measuring cup, teaspoon, cookie sheet, butter, baking soda, salt, chocolate chips, oven.
7. Ditto, felt board, felt.
8. Film:"Math Got You Bugged: Fractions."
9. Bingo pieces, Bingo cards.

Activities

1. Bulletin board
2. Paper plate and crayon idea
3. Egg carton and marbles activity
4. Making bean bags
5. Fish board idea
6. Baking cookies
7. Felt board relay game and ditto sheet
8. Role playing with word problems
9. Conversion bingo
10. Film and quiz.

Culminating Activities

1. Summarizing Content
   a. Have a student explain the bulletin board to the rest of the class. Invite comments and questions to encourage a group discussion.
   b. Discuss the film. Ask each student to write a very short summary or comment about the film.

2. Sharing with Others
   a. Ask for students to volunteer to read their summary or comment aloud to the rest of the class.
   b. Divide the class into five groups. Have each group choose an occupation and go in front of the class and role-play, involving fractions in any way they can. Encourage them to use the pictures they were asked to find, as well as examples from the film.

3. Checking on Learnings
   a. Give a quiz involving the addition of fractions with the same denominator, subtraction of fractions with the same denominator, addition and subtraction of fractions with different denominators, simplifiying fractions and conversion of mixed numbers.

Estimated Time Schedule

1. Introduction-2 days
2. Concept taught-4 days
3. Review-1 day
4. Application-2 days
5. Conclusion and summary-1 day

Relationship to Other Areas

1. Reading- Language - Students will learn such vocabulary as fraction, addition, and subtraction. Reading practice can also be done through word problems.
2. Spelling - The bulletin board activity will include posting new career and vocabulary words learned which will be emphasized over a ten day period.
3. Art - The students will be making bean bags, coloring plates for pies and cutting out pictures for the bulletin board which will involve art.
4. Economics - Through making cookies, children can get a sense of how much it costs to feed a family.
5. Career Education - The children will learn about different careers which use fractions. In the bulletin board activity the children will cut out career picture and learn about different careers.

Teacher References

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Forbes, Jack E. and Robert E. Eicholz, Mathematics for Elementary Teachers, Addison-Wesley Publishing Company, 1971.

Green, George F. Jr., Elementary School Mathematics, D.C. Heath and Company 1974.

Kramer, Klaas, Teaching Elementary School Mathematics, Allyn and Bacon, Inc. 1975.

Mahaffey, Michael L. , Teaching Elementary School Mathematics, F. E. Peacock Publishers, Inc., 1973.

Westcott, Alvin, and James Smith, Creative Teaching of Mathematics, Allyn and Bacon, Inc. Boston, 1971.

Lesson 1

Topic: Fractions and their relation to careers and daily life.

Specific Goals:

1. The students will be able to relate fractions to careers.
2. The students will have some understanding of how fractions are used.

Teaching Strategies:

Bulletin board
Discussion

Materials:

1. Magazines
2. Scissors
3. Construction paper
4. Paste
5. Straight pins
6. Staplers and staples

The Plan:

1. Readiness Activities:
   a. Review of how mathematics is an important part of careers and daily life.
   b. Discussion of what ways they think fractions can be used.

Lesson Development:

1. Each of you have a magazine on your desk. Look through it and select pictures of people and careers that may use fractions. While doing this, think of how these people and careers use fractions. Make a list of how you think these people use fractions.
2. (Class Discussion) What careers did you find? Make a list on the board. What do you think the job entails? How would these people use fraction? Do you think both men and women can hold these jobs? Whom do you know working at these types of jobs?
3. With the pictures you have found, we are going to make a collage bulletin board. Divide the class into groups.
   Group 1 - Responsible for lettering
   Group 2 - Responsible for putting up background paper
   Group 3 - Responsible for collecting all pictures
   Group 4 - Same
   Bulletin board should have black letters with the title at the top. Form a collage with the pictures and place it under the title. Finally, they should have the name of the occupations, as they are listed on the board, put on top of the pictures with the straight pins.

Participation:

1. Individuals cutting out magazine pictures
2. Entire class for discussion
3. Small groups for bulletin board
4. Entire class for summary.

Conclusion:

1. Have the students hand in the lists that they have made.
2. Complete the bulletin board by putting up lettering and pictures.

Lesson 2

Topic: Simplification of fractions and fractions as a whole.

Specific Goals:

1. The students will be able to understand how fractions make up a whole.
2. The students will be able to simplify larger fractions into smaller ones.

Teaching Strategies:

1. Discussion
2. Demonstration

Materials:

1. Paper plates
2. Crayons
3. Pencil and paper
4. Text book

The Plan:

1. Readiness Activities:
   a. Review the idea that fractions are part of a whole.

Lesson Development:

1. Take a paper plate and a red crayon. Color the plate so that it looks like a plain pizza. Demonstrate that if you cut the pizza into 4 parts and eat 1 piece, this piece is 1 out of 4 parts or ¼ of the whole. Make sure they understand that all these fractions of the pie are part of the whole pizza. Then have the students come up with some of their own fractions of the pie using different denominator. You can add some fun to the pizza by having them put their favorite toppings on the different fractions of the pizza.

2. Have the students make another pizza plate. Cut the pizza into 4 parts. Explain that there are 4 out of 4 parts or 4/4. Then show that this is also equal to 1. Use some other examples. Have students come up with some fractions to simplify..

3. Have the students experiment on their own with a third paper plate. Let them pretend they are a pizza person and give them each a type of pie to make with a different topping. Use fractions that can be simplified: 8/12= 2/3.

Participation:

1. Entire class for explanation and demonstration of pizza idea.
2. Individual work as they do their own pizzas.
3. Entire class for summary of material.

Conclusion:

1. Have students hand in pizzas.
2. Have studnts do problems in text p. 287 #1-5eyen,11-22 eyen, and 24-34 even.

Lesson Plan 3

Topic: Addition of fractions with like denominators

Specific Goals:

1. To enable the students to use their knowledge of fractions to add two fractions and arrive at a sum (skill).
2. To enable the students to be able to use fractional numbers in familiar situations.
3. To allow the students to actually see the answers by manipulation of materials.
4. To enable the students to understand how the amounts increase when fractions are added together

Teaching Strategies:

1. Discussion of fractions and their use.
2. Teach skill through computation of problems with learning activities.
3. Add fractions with marbles and empty egg cartons.
4. Problem solving techniques.

Materials:

1. Paper, pencils
2. Ditto of problems to do - p. 288, # 1-16; p. 289 # 17-31 odds; and 32-46 all.
3. Enough egg cartons so that each child gets one.
4. Marbles.

The Plan:

1. Readiness Activities:
   a. Review briefly what fractions are and how to simplify them.
   b. Look at and discuss the bulletin board with the careers
      1. Think of a few others.
      2. Avoid stereotyping
   c. Draw rectangle on board, divided into three equal parts and shadein two parts.

Lesson Development:

1. Examine the rectangular drawing on the board and discuss what parts are shaded. How much is shaded if you put two squares together? How much is not shaded? Notice that each area is one-third of the whole. Explain that we add the numerators when the denominators are the same. If I write 1/3 + 1/3 for each of the shaded areas, and I add the numerator I get 1 + 1 = 2 or 2/3. So two-thirds of the entire rectangle is shaded.

2. Draw another rectangular drawing and divide it into four equal parts. If I shade in two of the four squares I have ¼ + ¼. What do I do to the numerator? What do I get? What fourth of the whole is shaded.

Lesson 3 cont.

3. Distribute an empty egg carton to every three children and 12 marbles to each child. There is one rule, only one marble can be placed ineach space. By placing one marble in a space, fill one-half of the spaces. Then fill another half of the spaces. What fractionof all the spaces is filled? So ½ + ½ =

Using the 12 empty spaces and the marbles, find the answers to:

a. 1/12 + 5/12 = b. 3/12 + 7/12 = c. 1/12 +6/12 =

Divide the carton in half so that you can work with six spaces. Compute the following:

a. 1/6 + 4/6 = b. 2/6 + 4/6 = c. 3/6 + 1/6 =

Split the six spaces in half so that you have three and join these with the remaining six spaces from the other half of the carton and compute:

a. 2/9 + 3/9 = b. 4/9 + 5/9 = c. 1/9 + 7/9 =

Also write out the answer next to the fraction: ex. ½ = one-half.

Participation:

1. Entire class for chalkboard work
2. Individual work for the ¼ rectangle
3. Small group work for the marble problems

Conclusion:

1. Homework - Do the problems on p. 288 # 1-16
2. Also do p. 289 # 17-31 Odds.
3. Go to the supermarket during the week to see if it is better to buy one ½ dozen carton or one dozen.
4. For tomorrow think of careers where you would use fractions.
5. How do you use fractions at home?
   1. Ask members of your family if they use fractions.
   2. Can your mom and/or dad do the same things with the fractions?
6. If you started with a full carton of marbles and took some out, how do you think you would find the answer? Think about it.

Lesson 4

Topic: Subtraction of fractions with like denominator.

Specific Goals:

1. Students will understand the concept of taking away and having less.
2. They will have the skill in subtracting two fractions.
3. They will get experience in creating, measuring materials and have the fun of making bean bags.
4. They will realize that sewing is something that can be done by both sexes.

Teaching Strategies:

1. Discussion of the concept of subtraction
2. Teach skills through problem solving
3. Manipulation of fractions by making bean bags and filling them with lima beans
4. Both sexes work together to avoid stereotyping.

Materials:

1. Paper and pencils
2. Ditto with problems from p. 290 # 1-18, p. 291 # 19-33 evens
3. Frabric, masking tape, lima beans
4. Ruler, scissors, measuring cup

The Plan:

1. Readiness activities:
   a. Review addition of fractions. Assign problems #32 and 44 on p. 289.
   b. Introduce subtraction by drawing a pizza on the board and divide it into 8 slices. Erase 1/8 at a time until only half the pie is left.

Lesson Development:

1. Put the example 4/8 - 1/8 = 3/8 on the board and explain that we subtract the numerators when the denomintors are the same. If I have 4/8 of a pie and I take away 1/8 how much do I have left? If I have 5/8 - 1/8, how much do I have left?
2. Get into groups of four and take two 4" by 4" squares (each)of materials from the suuply the teacher puts out. How many squares of material should each person have? Cut four pieces of masking tape each six inches long. Use your ruler. Put material together by taping three of the four sides together. How much of your square is taped?
3. Now we have a pocket with what fraction left open?
4. Every group get a measuring cup and will take some lima beans. Everyone in group on: Fill the cup 1/4 with beans and then add 2/4 and put into the bag.
   All in group two: Fill the cup 1/3 and add 2/3 and put beans in the pocket.

Lesson 4: cont.

All in group three: Fill the cup 3/4 and take away 1/4 and then put the beans in the bag.

Everyone in group four: Fill the cup 2/3 and subtract 1/3 and put beans in the bag.
When each group finishes, put tape on the remaining open side. Now we all have bean bags,each filled with different amounts of beans.

Participation:

1. Pairs
2. Groups of four
3. Individual in that each child makes a bean bag.

Conclusion:

1. Take the bag home and ask your Mom or older relative to help you sew two sides 1/4 of an inch from the tape.
2. Ask your father or older relative to help you to sew the remaining two sides.
3. Bring your finished bags in tomorrow.
4. Do the problems on p. 290, 1-18 and 19-32 evens.
5. Make a list of occupations and people you know who use fractions to sew or measure.

Lesson 5

Topic: Addition and subtraction of fractions.

Specific Goals:

1. The students will be able to add and subtract fractions with unlike denominators.

Teaching Strategies:

1. Use of "Fruit Board". The top of this board has a variety of fruit cut-outs of cardboard on it. The bottom row of this board is filled with hooks which have possible answers on them. The student must choose a fruit, then put it on the proper hook. The type of fruit is written on the back of each card.

Materials:

Fruit Board with a variety of fruit and fruit hooks

The Plan:

1. Readiness Activities:
   a. Review simplification of fractions and addition of fractions with like denominators.

Lesson Development:

1. Use a structured approachso the students have a basic knowledge needed to add and subtract unlike denominators.
2. Give the students time to develop their skills with the fruit board.
3. Have the students do problems 1-10 p. 292-293 in their textbook for homework
4. Summarize addition and subtraction with unlike denominators.

Participation:

Entire class for structured learning.
Small group for fruit board.
Entire class for summary lesson.

Lesson 6

Topic: Adding and subtracting fractions.

Specific Goals:

1. The students will be able to add and subtract fractions with unlike denominators.

Teaching Strategies:

1. Have the students make, with the teacher's guidance, a batch of chocolate chip cookies, measuring the ingredients as the lesson progresses.

Materials:

Measuring cup, teaspoon, tablespoon, cookie sheet, butter, sugar, baking soda, salt, chocolate chips, the home economics room oven.

The Plan:

1. Readiness Activities:
   a. Review simplification of fractions and addition and subtraction of fractions with like denominators.

Lesson Development:

1. Have the students compute the proper amount needed for each ingredient to make the cookies. For example, "We have a whole cup of sugar but we only need 3/4 of a cup. How much sugar should we take away?"

2. Discussion:
   a. What is the measure of flour? of salt?
   b. Which ingredient isn't measured by a cup or spoon?
   c. Which ingredients aren't liquids?
   d. After blending the ingredients, what must you do before you bake the cookies?
   e. At what temperature do you set the oven?
   f. For how long do you bake the cookies?
   g. Can both men and women enjoy cooking?
   h. What jobs associated with cooking/foods can you think of? Can both men and women do these jobs?
3. Enjoy cookies while summarizing.

Followup Activities: Discuss nutritional aspects of the ingredients used.

Recipe for Chocolate Chip Cookies:

one cup butter
3/4 cup granulated sugar
3/4 cup brown sugar
tsp. vanilla
12 oz. package chocolate chips
2 eggs
2 1/4 cups flour
tsp. baking soda
tsp. salt

Combint butter and sugar, then vanilla and eggs. Mix in flour baking soda and salt. When this is creamy, add in your chocolate chips. Drop onto a cookie sheet. Bake at 375 for 8-10 minutes.

Enjoy!

Lesson 7

Topic: Review of lesson plans 3, 4, 5, 6

Specific Goals:

1. The students will be able to discuss the meaning and importance of fractions.
2. The students will be able to complete ditto sheets reviewing the processes of addition and subtraction of fractions
3. The students will be able to act and think spontaneously with regards to the mathematical thinking process in order to plot answers to problems on a felt board quickly and accurately.

Teaching Strategies:

1. Discussion
2. Application (ditto sheets)
3. Games Activity

Materials:

1. Chalkboard and chalk
2. "Ditto" sheets
3. Felt board and appliques

The Plan:

1. Readiness Activities:
   a. Review concepts: What is a fraction? What is the top number called? What is the bottom number called? Why do we need fractions? When do we use them? What kinds of things do you do with them? (measure, weigh)

Lesson Development:

1. Pass out "ditto" sheets:
   a. p. 1 - problems dealing with simplifying fractions
   b. p. 2 - problems dealing with adding and subtracting fractions with the same denominator
   c. p. 3 - problems dealing with additon and subtraciton of fractions with different denominators.
2. Discussion:
   Who would use fractions? How would a pizza maker use fractions? A baker? A seamstress?
3. Learning station:
   a. Divide the classinto two teams. Team 1 will work on the left side fo the felt board, and team 2 will work on the right side.
   b. The first set of races will be using pizza slices.
      The second set of races will be using measuring cup measurements.
      The third set of races will be using arrows on a yard stick.
   c. Give the contestants racing each other a slip of paer with the same problem on it. They must run to to the felt board and diagram their answer.

Lesson 7 cont.

Example: ½ + ½ = ? The two contestants must run up to the felt board and
1. put up two halves or 8 slices of felt pizza or
2. put up a line across a felt measuring cup where the 1 cup mark is or
3. put up a felt arrow pointing at the one foot mark

Participation:

1. Entire class for discussion
2. Entire class for ditto sheets
3. Teams for learning station

Conclusion:

1. Identifying the Principles:
   What was the point of using pizza slices, measuring cups. and rulers to identify fractions? Can you name other occupations that use fractions?
2. Assignment: Think of three occupations which use fractions. Be prepared to discuss the importance and use of each. Try to find pictures of people at jobs that use fractions.

Lesson 8

Topic: Word Problems

Specific Goals:

1. The students will be able to apply their basic knowledge of fractions, (addition and subtraction), to work problems using everyday situations.
2. The students will realize that there are no sex-stereotyped occupations in today's world.

Teaching Strategies:

1. Application (problem sheets)
2. Pictures
3. Construction paper and tape

The Plan:

1. Readiness Activities:
1. Pass out the problem sheets. Have volutneers read the problems aloud:

a. John and Kathy are on the racing team. They both run the one mile rely. One day, John ran the race in three minutes ten seconds. Kathy ran the same race in three and a half minutes. Translate the seconds into fractions remember that one minute = sixty seconds. Who won the race? By how much time? Reduce your answer to the smallext fraction.

b. Sam is a male nurse. Everyday at 2:00 he gives Mr. Jacobson a half cup of blue medicine, three quarters cup of red medicine, and and 1/12 cup of yellow medicine. How much medicine does Mr. Jacobson take everyday? How much medicine would he take if he didn't give him the yellow medicine? Reduce your answer.

c. A navigator named Ella wanted to find the quickest way to get from point A to point B. She found three routes. Routel was six and 1/3 miles. Route ll was six and 2/6 miles. Route lll was six and 8/24 miles. Which route is the shortest? Which route is the longest?

d. Nancy and Dan are bankers. They have to count the money every day at 5:00. Yesterday, Nancy had sixty dollars and forty cents in one drawer and fourty dollars and twenty cents in another drawer. Dan had twenty-two dollars and ten cents in one drawer and fifty dollars in the other. How many dollars did Nancy have? How many dollars did Dan have? If 100 is the denominator, how many cents does Mary

Lesson 8 cont.

have in fraction form? How many cents does Dan have in fraction form? Who has the larger fraction? By how much?

Learning Stations:

1. Have volunteers be the characters in the word problems and act out the problems with the answers before the class
2. Use construction paper for props, such as numbers for the racers, a hat for the nurse, and paper money for the bankers. Also use cups for the nurse.

2. Discussion:
Who has other occupations that use fractions? Show your pictures to the class and explain how the person would need to use fractions.

Participation:

1. Entire class for problem sheets.
2. Six individuals for the role-playing.
3. Entire class for discussion.

Conclusion:

1. Collect pictures to make mural for the wall.
2. Announce quiz scheduled for two days from today.

Lesson Plan 9

Topic: Conversion

Specific Goals:

1. The students will be able to convert fractions into mixed numbers and back to fractions. This should also strengthen the concept of fractions as a part of a whole.

Teaching Strategies:

1. Discussion
2. Demonstration

Materials:

Bingo cards, 2 sets (one with fractions and one with mixed numbers
Chips

The Plan:

1. Readiness activities:
   a. Review of addition and subtraction of fractions and ability to recognize fractions as a part of a whole.

Lesson Development:

1. Review concepts of fractions as a part of a whole . Write fractions on board and have a student come up and write the conversions. After students understand this concept pass out one set of Bingo cards and a set of chips. Then call out a mixed number, example 3½ and have students put a chip on 7/2. After playing two or three games, switch cards and call out fractions and have students put chips on mixed numbers.

Discussion:

1. How are fractions a part of a whole? Show the pizza idea.
2. How can a fraction be equal to a mixed number? Use circles divided into four parts. Take 2½ circles to represent the fraction 5/2.
3. Summarize the lesson.

Participation:

Entire class will participate in both discussion, Bingo and summary of lesson.

Conclusion:

1. Pass in Bingo cards and chips.
2. Review of addition, subtraction and conversion of fractions.

Lesson 10

Topic: Culmination of unit,

Specific Goals:

1. To review facts learned in this unit and to quiz students on material learned.

Teaching Strategies:

1. Discussion
2. Demonstration
3. Testing

Materials:

Film: Math Got You Bugged: Fractions, NBC films, 1971
Quiz

The Plan:

1. Readiness Activities:
   a. Review addition, subtraction and conversion of fractions.

Lesson Development:

1. Introduce movie and explain to students that this is a movie about fractions and how they relate to daily life. The film lasts 13 minutes. Give the quiz to the students and allow remaining time for them to ask questions and work on any problems.

Discussion:

1. Tell students about the film and give them a general preview of how it relates to the lesson.
2. Explain quiz and answer questions.

Participation:

Entire class will see film and take quiz.

Conclusion:

The film and quiz end this lesson. Students should now have a firm understanding of addition, subtraction and conversion of fractions.

Lesson 10 - Quiz

Name_____ Date_____

Complete the following problems:

1/4 + 2/4 =

3/16 + 2/16 =

3/8 + 1/2 =

3/5 + 1/10 =

3/8 - 2/8 =

4/5 - 1/5 =

10/16 - 1/4 =

4/6 - 1/3 =

Place equal or not equal signs in the following equations:

6/4 _____ 1½

10/5 ___ 2

24/10 ____ 2 2/5

9/3 ____ 2 2/3

9/1 ____ 1/9

5 1/5 ___ 26/5

Solve the following word problems:

Jack is making a cake for his mother's birthday. He needs a cup of sugar to finish the cake but he only has 1/3 cup. How much more sugar musthe use to finish the cake?

Cathy has two pieces of fabric, one is 3 2/3 yards and the other is 2 1/6 yards. How many yards of fabric does Cathy have?

Grade Six

Unit Plan

on

Multiplication and Division of Fractions

by

Dr. Anne M. Claytor, S.C.
Dr. Antoinette J. Messina

Sixth Grade

Multiplication and Division of Fractions

1. Rationale:
   A. General Objectives:
      1. Students will explore different career functions.
      2. Students will have an understanding of multiplication of fractions.
      3. Students will have an understanding of division of fractions.
      4. Students will have an understanding of the distinction between compound and simple fractions.
      5. Students will be able to apply fractions to practical problems.
      6. Students will be able to determine when fractions are equal.
      7. Elimination of stereotyping.
      8. Enhance skills in working together and cooperation.

   B. Specific Objective:
      1. The student will be able to demonstrate the ability to multiply simple fractions.
      2. The student will be able to demonstrate the ability to divide simple fractions.
      3. The student will be able to identify simple and compound fractions.
      4. The student will be able to identify equal fractions.
      5. The student will be able to compute the greatest common factor.
      6. The student will be able to solve practical word problems using his knowledge of fractions.

Unit Content

Text: Duncan, Ernest R. (Coordinating Author). Mathematics. Boston, Mass., Houghton Mifflin Company, 1978. Unit 6 - pp. 120 - 143.

Lesson 1
Introduction: General review of fractions

Lesson 2
Multiplication and division of fractions

Lesson 3
Equal fractions

Lesson 4
Simplifying fractions

Lesson 5
Simplifying fractions using the G.C.F.

Lesson 6
Comparing fractions

Lesson 7
Mixed numbers

Lesson 8
Problem solving

Materials

Bag of sand, beans, bowl, buckets (3), charts, colored chalk, construction paper, cut out displays of fractions, diagrams, dittos, foil, food (cake,jello), game cards, geometric shapes, hangers, knives, magic markers, math text (pp. 128-129), measuring cups, multiplication tables, napkins, paper discs, paper plates, pencils, pennies, picture, ruler, sand shovel, scissors, string, wire.

Activities

1. Demonstrations with class, jello, cut outs
2. Discussions on the content
3. Games
4. Charts
5. Hands on activities through learning stations
6. Role playing

Culminating Activities

1. Summarizing content - cut out pictures from magazines, etc. of occupations that use fractions and bring them into class.
2. Sharing with others - discuss together the pictures they brought in and how they relate to fractions.
3. Checking on learnings - have the students act out the pictures they brought in and demonstrate the use of fractions

Estimated Time Schedule

1. Introduction - 1 day
2. Content - 7 days
3. Culminating activity - 1 day
4. Summary and evaluation-1 day

Relationship to Other Curriculum Areas

1. Reading - word problems (comprehension)
2. Language - discussion and social awareness
3. Spelling - usage with game cards
4. Art - Mobiles
5. Career education - role playing
7. Science - properties of water, sand, pennies, beans, (different weights), science word problems.
8. Social Studies - awareness of society around us and its attitudes toward stereotyping.

Lesson 1

Topic: Introduction: A review of fractions.

Specific Goals:

The students will be able to recognize fractions and explain the significance of fractions.

Teaching Strategies:

1. Discussion
2. Demonstration
3. Role-playing

Materials:

1. Pictures
2. Cardboard geometric shapes
3. Charts

Readiness Activities:

1. Show pictures and discuss briefly why people need to measure things.
2. Have students look around classroom and find examples of fractions (torn pieces of paper, small pieces of chalk, used pencils, 1 glove, etc.)

Lesson Development:

1. Discussion - What is a fraction?
   a. Have students identify fraction by recognizing form.
   b. Have students identify numerator, denominator.
2. Demonstration - Divide class into unequal groups and have each group determine what fraction of the class their group represents.

Participation:

Entire class for discussion and demonstration.
Entire class for review.

Conclusion:

1. Review of material covered
2. Homework : Identification of fractions and their parts.
3. Have students make posters and charts showing some common fractions.
4. Have students make posters identifying the numerator and denominator of a fraction.

Lesson 2

Topic: Introduction to multiplication and division of fractions.

Specific Goals:

1. The students will be able to multiply and divide fractions.
2. The students will be able to explain the various properties assumed by fractions when they are multiplied and divided.

Teaching Strategies:

1. Discussion
2. Demonstration

Materials

Charts
Cardboard geometric shapes

The Plan:

1. Readiness Activities:
   a. Discussion: Ask students, "Would you rather have 1/8 or 1/16 of a pie?" Springboard for explanations - the larger the denominator, the smaller the fraction and vice-versa.

Lesson Development:

1. After explaining the process, have children do a few problems - ½ x ½; ½ x 1/3, etc.
2. Based on above discussion, have students determine whether the product is greater or smaller than the factors and explain their answer.
3. Practice multiplication of fractions and reinforce the concept of the lesser product.
4. Review the reciprocal property.
5. Using this property, explain the division process and have the students do a few problems - 1/3 ÷ 1/2 = 1/3 x 2/1.
6. Based on the above discussion, have students determine whether the quotient is greater or smaller than the dividends. Have students explain their answer.
7. Reviewdivision of fractions and reinforce the concept of the greater quotient.
8. Have the students practice both types of problems at the blackboard.

Participation:

Entire class for discussion and demonstration.
Individual work for demonstration at chalk board.

Conclusion:

Overall review.
Homework assignment
Have students make posters and charts explaining the reciprocal property and the concepts of the greater quotient and the lesser product.

Lesson 3

Topic: Equal Fractions

Specific Goals:

1. The students will be able to identify equal fractions.
2. The student will be able to compute one fraction to a different fraction of equal value by multiplication.

Teaching Strategies:

1. Discussion
2. Experimentaion
3. Simulation Game

Materials:

Jello, magic markers, napkins, paper, paper plates, pencils, plastic knives, pot, scissors, water, and game cards.

The Plan:

1. Readiness Activities:
   a. Discussion on how different people use parts of a whole. For example, " When Mom is serving a cake for eight people, what portion of the cake does everyone get? When splitting a candybar with a friend, what portion does he/she get? Can Mom cut pieces of the cake that will equal one half of the candy bar you gave your friend?" Let's make jello and see if we can do this. Student will then follow directions from a recipe to make jello that will be used to demonstrate equal fractions.

Lesson Development:

1. Using different jello molds, students will cut them into halves, fifths, sixths, eighths, tenth, and twelfths.
2. Through observation students will tell how many quarters equal one half, and so on for the various denominators given
3. Rule: We can make a fraction equal to another by multiplying it with a numerator and denominator of equal value. Ex. 1/4 x 2/2 = 2/8 3/6 x 3/3 = 9/18
4. How many different fractions can you find equal to one half? to one quarter? to one sixth? to one tenth ? Can you come up with some others?
5. Culminating activity: Simulation game with cards.

Participation:

Entire class for discussion
Small groups for demonstration
Individual work for finding equal fractions
Small groups for simulation game

Lesson 3 Cont.

Conclusion:

Assignment follow-up activities
Simulation game called "Math Match"
Students must match the picture with the appropriate numeral and the appropriate word. Concentration can then be played matching one numeral with an equal fraction.

Students will first connect the proper pieces to form a complete puzzle. Then concentration can be played by matching this card with that of an equal fraction.

Lesson 4

Topic: Simplifying fractions in a sequence of steps.

Specific Goals:

1. Given a fraction the students will be able to reduce it to its simplest form
2. The students will be able to identify a fraction which is simplified and a fraction which is not simplified.
3. The students will be able to identify a common factor and use a common factor when simplifying fractions.

Teaching Strategies:

Discussion
Demonstration

Materials:

Multiplication Tables
Diagrams
Textbook
Colored displays of fractionsfor reference
Colored chalk

The Plan :

1. Readiness Activities
   a. Review the concept of factoring
   b. Review the process of division
   c. Review equal fractions

Lesson Development:

1. The students willdiscuss and review division as a process of reducing numbers. They will discuss the process of factoring numbers.
2. Given a list of numbers the students will demonstrate their ability to factor by finding the factors of each number.
3. Demonstrate the concept of simplified fractions being equal to their respective unsimplified fraction. Using diagrams of two pies, one which uses a fraction that is simplified and the other one which is unsimplified, the students will be able to see they are both equal.
4. Given a simple fraction have the students multiply the numerator and denominator by the same number to determine an unsimplified fraction which is equal to the original fraction.
5. Using a multiplication table the students will determine the factors of both the numerator and then the denominator Then they will be given a fraction on the board in which they will write out the factors of each component part of the fraction. Go to the board and color the factors which are common to both the numerator and the denominator.
6. Given a worksheet on fractions, the students will work individually to determine their simplest form using as many steps as necessary.

Lesson 4 cont.

Participation:
Entire class for discussion and demonstration
Individual worksheet assignment

Conclusion:
1. Turn in worksheet on simplifying fractions.
2. Written homework on simplifying from the textbook.
3. Have student think why we simplify fractions.
4. Make a list of things that become easier by simplifying fractions.

Lesson 5

Topic: Simplifying fractions using the greatest common factor.

Specific Goals:

1. The students will be able to identify the greatest common factor.
2. The students will be able to simplify fractions in one step by using the Greatest Common Factor (GCF).

Teaching Strategies:

1. Discussion
2. Demonstration

Materials:

1. Paper disc
2. Colored paper.
3. Dittos

The Plan:

1. Readiness Activities
   a. Have the students make a list of things which they consider great.
   b. Review the concept of common factors.
   c. Discuss the difference between greatest and least.

Lesson Development:

1. Review by having the students find the common factors of specific fractions.
2. Discussion on the meaning of "greatness".
3. Usingpaper discs to represent the factors of the numerator and denominator, demonstrate the concept of the greatestcommon factor of a fraction.
4. Have the students find the GCF's for a number of fractions. (worksheet).
5. Have the students go to the board, simplify a fraction by using the GCF and draw a pie illustrating the final simplified fraction.
6. Divide the class into groups. Give the groups the same fraction, have them determine the Greatest Common Factor and the simplified form as quickly as possible. One member goes to the board and writes down the Greatest Common Factor and the simplified fraction.
   Play until each member of the group goes to the board.

Particpation:

Entire class for discussion and demonstration.
Individual on the worksheet assignment.
Groups for the fraction game.

Conclusion:

1. Hand in GCF worksheet.
2. Written homework on GCF from the text.
3. Write a paragraph explaining why they would use the GCF.

Lesson 6

Topic: Comparing Fractions

Specific Goals:

1. The students will be able to identify the larger or the smaller of two fractions.
2. The student will be able to compare unlike fractions by converting them to equal fractions throught the process of multiplication and a common factor.

Teaching Strategies:

1. Discussion
2. Simulation game

Materials:

Paper, pencils, pictures, and game plan

The Plan:

1. Readiness Activities:
   a. Review of equal fractions and common factors.

Lesson Development:

1. Students will look at pictures brought in on use of fractions. Discussion will follow, It is easy to compare fractions with the same denominator but how can we compare fractions that have different denominators? Is one half larger than one quarter? Is one sixth smaller than one twelfth? How might we go about comparing these fractions?
2. Rule discussion: To compare 2/5 with 4/15 we must multiply five with another number that equals fifteen. We will then have equal fractions and it will be easy to determine which fractions is larger or smaller.
3. Students will then compare various fractions in small groups to determine which is larger and which is smaller.
4. Culminating activity: Simulation game.

Participation:

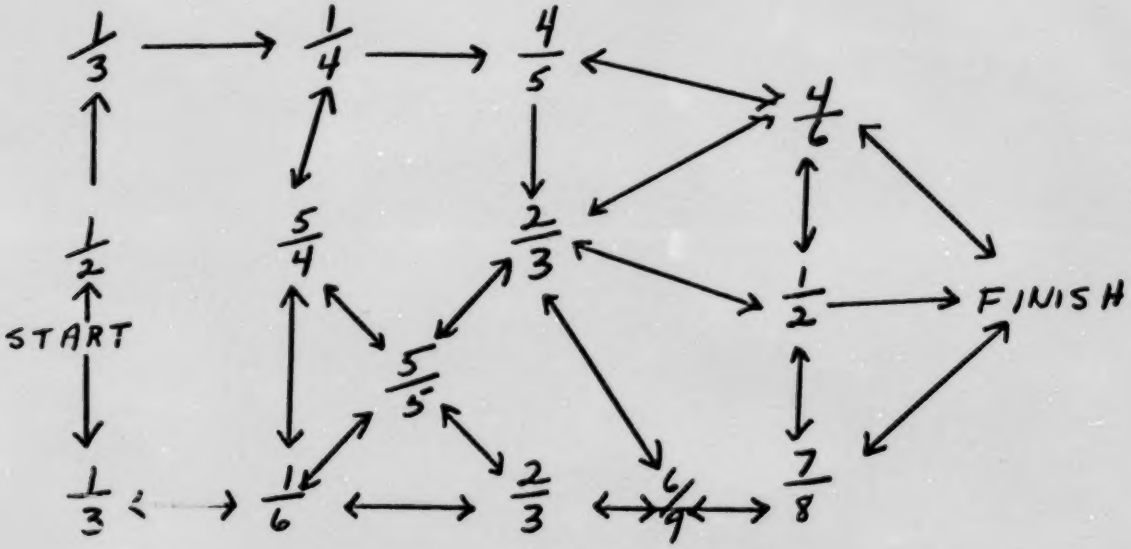
Entire class for discussion and answer.
Small groups for computation and simulation.

Conclusion:

Assignment follow-up activities
Simulation game called: What's the Smallest Product to the Finish?
Object: Each student must choose a path from start to finish such that the product of the fractions along the path will be smaller than the product along any other path chosen by other pupils. After the product of each pupil's path has

Lesson 6 cont.

been computed, products must be compared to determine the winner. Practice is gained in multiplication of fractions and also in determining a common factor for comparison at the end.



Though this seems somewhat confusing - it is rather simple. Students will learn how to follow paths to reach the end (finish). Numbers can be switched around to smaller denominators.

Lesson 7

Topic: Mixed Numerals

Specific Goals:

1. Write a mixed numeral as a whole number and fraction.
2. Write a whole number and a fraction less than one as a mixed number.
3. Rewrite a mixed numeral as a fraction.

Teaching Strategies:

Class discussion and experimentation through group work.

Materials:

Construction paper, magic markers, scissors, foil, wire, hangers, measuring cups, a bucket of water, worksheets, bags of sand, beans, pennies, 3 buckets, 1 sand shovel and 1 bowl.

The Plan

1. Readiness Activities:
   a. Review the basic principles of fractions: addition, subtraction, multiplication and division.
2. Make hanging mobiles of mixed numbers with the whole numbers being the biggest number and cover it with foil to attract the student's attention. Make the fractional number smaller, but colorful also. Hang the whole number with the fraction.
3. Make fractional cut-outs from paper for several whole numbers and for ½, 1/3. 1/4, and 1/5 . Write mixed numbers like 1 1/3 on the board.

Lesson Development:

1. As the students come into the room, they will notice the mobiles of mixed numbers. Start a class discussion with them on what mixed numbers are - a whole number and a fraction. 5 minutes
2. Have the students look at the mixed numbers on the board. Call on some of the students to select the appropriate fractional cut outs for each written number. For example, if 1 3/4 is the problem on the board, he should select 7 cut outs representing fourths. Continue the activity until everyone seems to understand how fractions are the basis for mixed numbers. 5-10 minutes.
3. Switch the activity and write fractions on the board and have them pick out the whole number and fraction that matches it, such as 6/5 9/2, 8/3, etc. 5 minutes.

Lesson 7 cont.

4. Divide the class into 4 groups. Have each group go to 1 math station.

Station A, there will be worksheets, a bucket of water and some measuring cups. The group will answer the following questions:

1. How many cups are in 2 cups of water?
2. " " halves are in 4 1/2 cups of water?
3. " " thirds are in 2 2/3 cups of water?
4. " " fourths are in 1 3/4 cups of water?
5. " " fifths are in 3 1/5 cups of water?

Station B, there will be worksheets, beans, measuring cups, and a bowl. The group will answer the following questions:

1. How many cups are in 3 cups of beans?
2. " " halves are in 3 1/2 cups of beans?
3. " " thirds are in 2 2/3 cups of beans?
4. " " fourths are in 4 3.4 cups of beans?
5. " " fifths are in 2 3/5 cups of beans?

Station C, there will be worksheets, a sand bucket and shovel, sand, and measuring cups. The group will answer the following questions:

1. How many cups are in 4 cups of sand?
2. " " halves are in 1 1/2 cups of sand?
3. " " thirds are in 2 2/3 cups of sand?
4. " " fourths are in 3 3/4 cups of sand?
5. " " fifths are in 4 2/5 cups of sand?

Station D, there will be worksheets, pennies, a bucket and measuring cups. The students will answer the following questions:

1. How many cups are in 2 cups of pennies?
2. " " halves are in 1 1/2 cups of pennies?
3. " " thirds are in 2 2/3 cups of pennies?
4. " " fourts are in 3 3/4 cups of pennies?
5. " " fifths are in 4 4/5 cups of pennies?

5. Have each group present their results to the other groups . 5 min.

Participation:
Individual and group participation.

Conclusion: Assignment follow-up activities - Have the students check at home to see in what ways they use mixed numbers and write them.

Lesson 8

Topic : Mixed numerals

Specific Goals:

The students will be able to:

1. Demonstrate the use of multiplication with mixed numbers.
2. Demonstrate the use of division with mixed numbers and label each component of a division problem.

Teaching Strategies:

1. Class discussion
2. Group work
3. Games identifying charts.

Materials:

Construction paper, magic markers, rulers, and dittos.

The Plan:

1. Readiness Activities
   a. Review the basic principles of fractions:addition, subtraction, multiplication and division
   b. Make charts with the quotient, remainder, numerator, and denominator labeled on them and put them up around the room. Make the same charts without the labels.

Lesson Development:

1. Discuss with the students how to use multiplication with mixed numbers. An example is : There are 2 + 3/4 oranges. We can write the number of oranges as the mixed number 2 3/4. Also, use other examples.

   There are 4 fourthsin 1, $1=\frac{4 \times 1}{4} = \frac{4}{4}$

2. Write some problems on the board and have the students come up and solve them. For example:

   $2 = \frac{?}{5}$ $3 = \frac{?}{5}$

3. Discuss with the students how to use division withmixed numbers. To write 7/3 as a mixed number, we recall that there are 3 thirds in 1. So, we divide 7 by 3. The quotient 2 is the whole number. The remainder 1 is the numerator of the fraction and the 3 is the denominator.

4. Take some of the unlabeled charts with the division problems on them and put them on the board. Split the class into 2 teams and play "Name Your Game" . The object of the game is for the students to have any part of the problem such as numerator, denominator, quotient, remainder, or the mixed number itself. If they name it

Lesson 8 cont.

correctly, they get 2 points. If they miss and the other team can name it, they get 1 point. Whoever has the most points wins. 10 minutes.

Participation:

Individual and group participation

Conclusion:

Assignment follow-up activities - Give the students dittos with multiplication and division problems on them and have them find the mixed number involved wtih each problem.

Lesson 9

Topic: Problem Solving And Career Education

Specific Goals:

1. The student will be able to demonstrate the ability to apply his knowledge of fractions to solving practical problems as measured by an ability to do seven out of ten word problems.

2. The student will be able to list the occupations which require a knowledge of fractionsand demonstrate how these occupations (teacher will list them) use fractions as measured by the ability to get two-thirds of them correct.

Teaching Strategies:

1. Discussion
2. Problem solving
3. Demonstration

Materials:

Colored chalk, dittos, list of occupations

The Plan:

1. Readiness Activities:
   a. Review how to multiply and divide fractions using charts like the following one:

x	1/4
6	
1/8	
6/8	
3	

   b. Also review the concept that a fraction is part of a whole, by using colored chalk to draw different fractions of the whole and ask the students to identify the fraction.

Lesson Development:

1. After the second readiness activity, do the same thing except develop a word problem and have the students find the solution. For example: There are twenty squares on on the blackboard, 1/2 of themare blue and 1/5 of them are blue with white dots. How many are blue with white dots.

Lesson 9 cont.

Continue this step with different types of word problems for about ten minutes, making sure the students know how to interpret the problems.

2. Hand out to the students a ditto that has to do with word problems. Suggestion: Distribute something that is of interest, and that can be related to another subject area.

Discussion:

A list of twenty occupations will be written on the board. Discuss each occupation. What kind of work is done, where does the work take place and who can hold the position; man or woman? Ask the students which occupations use fractionsand how they use them. Conclude this step by having the students discuss people they know working at these jobs.

Participation:

Entire class for discussion and demonstration

Conclusion:

1. Ditto on word problems
2. Have the students go home and cut from magazines pictures of occupations that involve the use of fractions. Advise them to be prepared to show how these occupations use fractions.

Lesson 10

Topic; Carrer education and role playing using fractions.

Specific Goals:

1. The studant will be able to show the class by role playing how certain occupations use fractions.
2. The student will be able to list why fractions are important in everyday life.
3. The student will learn not to stereotype occupations.

Teaching Strategies:

1. Role playing
2. Discussion

Materials:

No special materials needed.

The Plan:

1. Readiness Activities:
   a. Review the discussion about occupations in lesson nine.

Lesson Developmnet:

1. Ask the students to take out their homework. Collect ditto and correct them later. Ask the students to place their pictures of occupations on their desks. Now divided the class into four or five groups. Tell the students to discuss their pictures within ther group and decide on one which they all want to act out. Remind them that what they want to show the class is how the occupations use fractions.

2. Allow five to ten minutes for the students to get organized, and then ask for a group to volunteer to act out their occupation. Have the remaining students try and guess what occupation the actors are acting out. When a correct guess has been made, ask the students if a man or woman should hold the job. Ask them how they would feel if they were to hold a job that was supposed to be for the opposite sex.

3. After all the groups have acted out their occupations, a full discussion should follow. Try to explain to the students what stereotyping is, incorporating how they said they would feel if asked to do so-called "woman's work" or "men's " work. Point out to them and discuss

Lesson 10 cont.

that the roles of men and women are changing and that stereotyping is being done less and less. Also discuss the importance of fractions in everyday life and occupations.

Participation:

Entire class for discussion.
Small groups for discussion and determining what occupations to act out.
Entire class for summary of lesson.

Conclusion:

1. The role playing of the students couldserve as a culminating activity by summarizing the overall discussion of fractions and their importance in every day occupations.

2. A unit test could be given at this time.

Teachers References

1. Jones, Daisy M., Curriculum Targets in the Elementary School, Prentice-Hall, Inc. Englewood Cliffs, New Jersey, 1977.

Grade Seven
Unit Plan
on
Decimals

by:

Dr. Anne M. Claytor, S.C.

Dr. Antoinette J. Messina

Seventh Grade

Decimals

1. Rationale
   A. General Objectives
      1. The children will see how decimals apply and are needed in both careers and everyday living.
      2. The children will recognize the lack of basis for the sex-role stereotypes that exist concerning math-related career.
      3. The children will understand and be able to work comfortably with decimals.

   B. Specific Objectives
      1. The children will be able to multiply fractions.
      2. The children will be able to add, subtract, multiply and divide decimals.
      3. The children will be able to round off decimals to the nearest whole number, tenth, hundredth or thousandth place.
      4. The children will be able to change fractions into decimals and decimals into fractions.
      5. The children will be able to find percentages.

Unit Content

Lesson 1:
   1. Discussion of the role that decimals play in different careers.
   2. Filmstrips: "Mathematics: Who needs it?"
      " Careers in Focus"
   3. After filmstrip discussion. Expanded views from film.

Lesson 2: pp. 66-69
   1. Review of concepts.
      a. Relationship of fractions and decimals
      b. Addition and subtraction of fractions
      c. Writing decimals as expanded numbers
      d. Comparing decimals (greater than or less than)
      e. Writing decimals in hundredths and thousandths

Lesson 3: pp. 70-84
   1. Multiplying by powers of ten

Lesson 4: pp. 85-158, 161
   1. Addition and subtraction with decimals

Lesson 5: pp. 164-165
   1. Writing fractions as decimals
   2. Rounding

Lesson 6: p. 178
   1. Multiplication of decimals

Lesson 7: p. 186
1. Multiplication of fractions, decimals and percents

Lesson 8: pp. 200- 201
1.Division with decimals

Lesson 9:
Culminating activity

Lesson 10:
Test

Text: Duncan, Ernest, R. (Coordinating Author). Mathematics. Boston, Mass. Houghton Mi-flin Company, pp. 66-67,85,69,164-165,158-161, 200-203,70-71,178,180,186

Materials

1. Textbooks(for all lessons) 2. filmstrips (lesson 2) 3. projector and casette player (lesson 1) 4. Paper and rulers (lesson 2) 4. unlined index cards-49 for each 8 children (lesson 3) 5. newspaer-supermarket coupon section (lesson 7) 6. food lists from previous day (lesson 8) 7. Hats (lesson 9)

Activities

1. Showing filmstrip
2. Building bulletin board of decimal fundamentals
3. Decimal card game
4. Making up word problems
5. In class practice
6. Construction of food list budget
7. Comparison of household budget
8. Construction of household budget
9. Word problems

Culminating Activities

1. Dramatic skits - mathematics role in occupations
2. Discussion - how both men and women need math in their job
3. Test on day 10

Estimated Time Schedule

1. Introduction - 2 days
2. Body - 6 days
3. Conclusion - 2 days

Relationship to other Curriculum Areas

1. Career education
2. Consumer education
3. Language arts
4. Dramatic arts

Lesson Plan 1

Topic: Decimals

Specific Goals:

1. Lesson will deal with the use of mathematics in different daily and career activities.

Teaching Strategies:

1. Filmstrips
2. Discussion

Materials:

1. Filmstrips: "Mathematics: Who needs it?" and "Careers inFocus"
2. projector 3. extra bulbs 4. extension cord 5. textbooks,
5. casette player

The Plan:

1. Readiness Activities:
   a. Ask the children when they use mathematics (decimals specifically) in everday situations.

Lesson Development:

1. Show filmstrips.

Discussion:

1. Ask the children what careers they have in mind for their future and discuss when and why mathematics is needed.

Learning Stations:

1. Have a cookbook with recipes and as a pretest see if the children can remember how to change the measurements to decimal values.
2. Have children gather information on math careers for future discussion.
3. Have the children form groups for a math bee to see if they remember past concepts.
4. Have children interview their parents about their jobs for discussion on day 2.

Participation:

1. Whole class for discussion of filmstrip.
2. Whole class for mini review of past concepts.

Conclusion:

1. Hand in papers of pre-tests.
2. Have children record their interviews for brief discussion on second day.
3. Summarize the activities of the day.

Lesson 2

Topic: Decimals

Specific Goals:

1. Lesson will review the basic concepts of :
   a. The relationship between fractions and decimal
   b. Writing decimals as expanded numbers.
   c. Addition and subtraction of fractions.
   d. Writing equivalent fractions.
   e. Comparing decimals (greater than, less than).

Teaching Strategies:

1. Discussion
2. Blackboard demonstrations

Materials:

1. textbooks 2. blackboard 3. chalk

The Plan:

1. Readiness Activities:
   a. Do a few problems for each of the specific goals so that the children can refresh their memories with these past concepts.

Lesson Development:

1. Discuss the interviews the children did.
2. Once the concepts have been reviewed, have the children open their texts to p. 66-69. As class assignment have them do problems 1-10 p. 66 on the board.
3. Go over the problems, answer any questions the children might have.
4. Have the children turn to p. 67 and go over completing the sentences orally.
5. Proceed to p. 69. Discuss and review equivalent fr- . Have the children do problems # 13, 16, 18, 19, 20, 23, 30, 32, 37, 41, 44, and 45.
6. Go over these problems in class.

Discussion:

1. Discuss first set of in-class assignment.
2. Discuss completing the sentence exercise.
3. Discuss final set of in-class assignment.
4. Discuss the children's interviews.

Learning Stations:

1. Have the children write the problems on the board so that the entire class can do a review of those specific types of problems.
2. Have the children tell which fraction is larger when reviewing and have them explain why.

Lesson 2 cont.

Participation:

1. Certain assigned children to perform specific in class problems.
2. Whole class to answer the completing the sentences exercise.
3. Whole class to discuss their interview.

Conclusion:

1. Final review of concepts.
2. Make sure each child hands in the second in-class assignment.
3. As homework have the children do all odd numbered problems on p. 67 from 21 - 50.
4. Also for homework do problems 51 -59.

Lesson 3

Topic: Decimals - Multiplication by powers of ten

Specific Goals:

Students will be able to:

1. Express as a decimal any fraction or mixed form having a denominator of 10 or 100.
2. Understand the relationship between the power of ten (no. of zeroes) and the position of the decimal point.
3. Match decimal names with pictorial drawing and number lines.
4. Recognize that these abilities are equally needed by members of both sexes.

Teaching Strategies:

1. Direct explanations of procedures involved
2. Practice problems
3. Games as reinforcers
4. Discussion with class participation
5. Homework assignments.

Materials:

1. Text p. 70, 71.
2. Decks of 49 "Old Maid" cards. Each set will accommodate 4-8 players, so they should be made up accordingly. Cards are composed of 12 groups of 4 cards each, with a decimal numeral or a multiplcation problem which names the same numeral, and an "Old Maid" decimal numberal card. Sample:

.3	$3 \times \frac{1}{10}$	Three Tenths	3 x .1

The Plan:

1. Readiness Activities:
   a. We already know that decimals equal fractions in that they are pieces of the whole, just as fractions are. For a decimal, the whole is always represented by a power of ten, for instance one-tenth or one-hundredth. Therefor, multiplication by a power of ten should have the effect of moving the decimal point to a different position. Today we will discover which powers of ten determine the direction of the decimal point, making the value of the number either larger or smaller.

Lesson Development:

1. Establishing the point of view:
   Look at the top of page 70. In the very first example, we see the problem: 10 X .3 . In the next step, what is .3 replaced with? What does the next step show? Does everyone understand how the final answer was derived? Look at the rest of the

Lesson 3 cont.

examples. Does anyone see a relationship between the number of zeroes in the power of ten and the direction of the position of the decimal point? Does there appear to be a faster way of doing this kind of problem? Try problems no. 3 and 12.

Look at the middle of the page where it says compare these examples. How are these examples similar to the ones above? How are they different? Does there appear to be a relationship between the position of the decimal point and the power of ten of the number being multiplied (30)/ Try problems 20 and 30.

2. Group Practice
Using our knowledge of multiplication by powers of ten, we are going to play a game called "Deci-Maid". The game is played according to the rules of Old Maid. The deck is shuffled and all cards dealt to the players. Initially, all the players may lay on the table before them each pair that names the same decimal number. Play then commences with the player immediately to the left of the dealer drawing one card from the dealer's hand. If the draw provides him another pair that names the same decimal number he may play them. Play continues in order, each player drawing one card from the player to his right until someone is left holding the single "Old Maid" decimal numeral card.

Discussion:

1. How might multiplication by powers of ten be used in real life? (i.e. money, percentages).
2. What sort of jobs can you think of in which you might need to know how to do this?
3. Do you think girls might need to know this more than boys?
4. Why or why not?
5. What would you like to be when you grow up?
6. Do you thing you'll need this in your occupation?
7. Why or why not?

Conclusion:

1. With what you've learned today, you will be able to quickly multiply any number by a power of ten and it will be very handy in everyday life for each of you.
2. For homework, and to be sure you fully understand the method, please try the following problems:
   p. 70 #4, 7, 15, 19, 31, 33-36
   p. 71 #1, 11, 17, 21, 40

Evaluation:

1. In class now I would like you to try the following problems to be handed in. This is not a test and will not be graded. It is just to be sure of how much you understand.
   Problems: p. 70 # 11, 23
   p. 71 # 6, 16, 35

Lesson 4

Topic: Decimals - Rounding and addition and subtraction.

Specific Goals:

1. Students will be able to:
   a. Round off a number to the nearest hundredth, tenth or whole number.
   b. Add and subtract decimals.
   c. Recognize decimal equivalents of percentages.
   d. See how these skills influence everyone's lives equally.

Teaching Strategies:

1. Teacher explanations.
2. Group Practice.
3. Class Discussion.

Materials:

1. Text pp. 85, 159 - 161

The Plan:

1. Readiness Activities: Establishing Purpose - Rounding
   a. When we want to know exact measures we generally carry out our decimal places as far as they can go. However, when we are only interested in approximation, we use a process called rounding, in which we make the number smaller and easier to work with. Can anyone thing of everyday uses of this process?
2. Establishing Purpose: Addition and subtraction of decimals.
   a. As we know, decimals play an important role in our everyday lives. For instance, we all use money which is made up in the form of decimals. Therefore, whether we realize it or not we often add and subtract decimals several times a day, for instance in receiving change for our money. Therefore, it is necessary to know the correct methods for doing it, if for no other reason than to be sure we are paying the correct amounts for what we buy. What other reasons can you think of?

Lesson Development:

1. Rounding:
   a. Read the top of p. 85 to yourselves. Does everyone see the concept here? Which numbers were eliminated through rounding off? Why? What happened to the numbers that preceded the eliminated numbers? What does this process depend on? What effect does the value of the number eliminated have on the consequent value of the number preceeding it? Try problems # 4, 12, 18, 22 and 34.

Lesson 4 cont.

2. Adding and subtracting:
   a. Turn to p. 158. Look at the examples at the top of the page. Is there any difference between adding and subtracting decimals and adding and subtracting whole numbers? What is the effect on the decimal point? Try problems # 5 20, 35 on p. 158 and # 39, 43 on p. 159.

      Look at problem 49 on p. 159. What does percent mean? How might 75% be written as a fraction. As a decimal? Which would be easier to add or subtract? Do problem #49.

      Turn to p. 160 and look at examples on top. Which method appears easier? Look at problems underneath. Using what we know about rounding, make an estimate of the answer of the first problem. Now do the problem as it is written. What was the difference between the actual answer and the estimate?

      Let's look at p. 161. How are the problems at the top of the page different from those we have seen up until now? What do we have to add in order to simplify the problem? Do zeroes change the value of the number? Why is it all right to add them? Do problem # 23.

Discussion:

1. We have covered areas of rounding, adding and subtracting. and the meaning of percentages today. How many examples can you think of in which ordinary people perform these operations?
2. Let's say that Mary is an architect or that Bill is a bookkeeper. Would they use these operations? How would Mary use them? How would Bill use them? How about Mary's clients? Should they know how to use them? Why or why not?
3. What occupations can you think of in which these will be used?

Conclusion:

We have covered a lot of very important ground today. We have seen how familiar operations can be applied to decimals and how much easier they are to work with than fractions. We have also seen again how decimals relate to each and every one of us. To be sure we understand these processes, I'd like you to try the following problems for homework:

p. 85 # 8, 10, 16, 20, 36
p. 158 # 9, 18, 24, 28, 36
p. 159 # 45, 47, 50, 52
p. 160 # 2, 6, 21
p. 161 # 28, 29, 40

Evaluation:

From now until the end of the period, I would like you to try to make up a word problem of you own using the Mary or Bill example or one of your own. This problem should cover at least two of the areas covered today, for example adding and

Lesson 4 cont.

percentages. It is to be handed in at the end of the period but will not be graded. If you finish before your time is over you may begin work on your homework.

Lesson 5

Topic: Teaching the use of decimals

Specific Goals:

1. The student should be able to write fractions as decimals and round off numbers containing decimal points.

Teaching Strategies:

1. Class discussions
2. Board work
3. Individual practice at seat
4. Homework assignment.

Materials:

1. Blackboard 2. chalk 3. math textbook

Readiness Activities:

1. Review rounding off (done on day 3)
   a. Have problems on board for individual students to solve.
   b. Have each student explain each step.
2. Review relationship between fractions and decimals through boardwork and class discussion.

Lesson Development:

1. Introduction
   We know how decimals relate to fractions. Now we want to be able to change any fraction into decimal form. We also want to be able to take that new number and round it off properly. In addition we want to learn how to round off numbers to enable us to estimate a product.

2. First step - group practice
   Demonstrate the process of changing fractions into decimals on blackboard. Ask students to help in process using what they already know about fractions and decimals. Continue with several problems until concept is made clear.

3. Second step - group practice
   Write examples of mixed fractions on blackboard ($2\frac{1}{2}$, $1\frac{3}{4}$).
   What whole numbers are these mixed fractions closest to?
   Estimate products of mixed fractions on blackboard.
   Then actually multiply mixed fraction and compare product to estimate. Also estimate products of number with decimals.
   Multiply the numbers and compare products with estimates.
   Continue with more examples until concept is clear.

Lesson 5 cont.

4. Third step - individual practice
   Have students practice problems indinidually from book. Leave time to go over any questions about either process before assigning homework. Students can practice on p. 164 #1-6, 13-18, 28-31 to the nearest tenth, hundredth and p. 165 # 52-57.

Participation:

1. Ask for student participation during teaching of new concept.
2. Have students work by themselves for practice.

Conclusion:

1. Assign homework p. 164 # 10-12, 19-27, 32-35 to the nearest tenth, hundredth and thousandth and p. 165 # 58-63.

Evaluation:

1. Collect homework and determine if students have satisfactorily mastered the skills. If they have not, review the concept focusing on the most problematic areas.

Additional Problem for Individual Practice:

Mr. Reynolds is the secretary to the president of a big company. His boss wants him to be more efficient so Mr. Reynolds decides to divide his duties into specific portions of the day. He decides to spend 4/7 of his day typing, 2/7 of his day taking dictation and filing and 1/7 on his break. Express these fractions in decimal form rounding them off to the nearest hundredth.

Ans. 4/7 = .57 2/7 = .28 1/7 = .14

Lesson Plan 6

Topic: Teaching the use of decimals.

Specific Goals:

1. The student should be able to multiply numbers containing decimal points.

Teaching Strategies:

There will be:
1. Class discussion
2. Board work
3. Individual practice at seat
r. Homework assignments

Materials:

1. Blackboard2. chalk 3. math textbook

The Plan:

1. Readiness Activities;
   a. Review the relationship between fractions and decimals, 2.5 = 25/10 and 4.62 =462/100, through class discussion.

Lesson Development:

1. Introduction:
   We know how add and subtract decimal numbers. Now we want to learn how to multiply two numbers containing decimal points.

2. First step - group discussion
   Change numbers into fractions and multiply numerator by numerator and denominator by denominator. Then determine by the denominator where to place the decimal point. Continue with several other examples.

3. Second Step - group discussion
   Demonstrate second method of multiplying both numbers if they were whole numbers. Then determine placement of the decimal point by adding the numbers of decimal places to the right of the decimal points in the factors. Continue with several other examples while students help in giving answers to each step.

4. Third step - individual practice
   Have students practice problems individually from the book. Leave time to go over any questions before assigning homework. Students can practice on p. 178 1-4, 9-14.

Participation:

1. Ask for student participation while teaching new concept.
2. Have students work by themselves for practice.

Lesson 7

Topic: Decimals - multiplication with fractions, decimals and percents

Specific Goals:

1. The children will be able to multiply with fractions, decimals and percnets.
2. The children will be able to -round off decimals to the nearest tenth place.
3. The children will be able to apply these methods by making up their own food budget list.

Teaching Strategies:

1. Whole class - explanation and discussion
2. Individual work - planning a food budget

Materials:

1. Newspaper sale section for a food store - one for each child

The Plan:

1. Readiness Activities:
   a. Review reducing fractions to lowest terms
   b. Review multiplication of fractions
   c. Review the changing of a fraction into a decimal

Lesson Development:

1. Explanation of what "percent" means
   75% = 75 out of 100 = 75/100 (and 75/100 can be reduced to 3/4, still having the same value)

2. Explanation of changing a percent into a decimal and a decimal into a percent 75% = .75 .50 = 50%

3. Relate this to multiplication of a number by a percent. Explain that the (X) means "of" 18% X 45 = 18% of 45
   810% =8.1 in decimal form

4. Explanation of multiplicaiton of decimals (included in lesson 6)

5. Explanation of rounding off numbers

Activities:

1. Give each child a newspaper flyer from a foodstore. Allot each child $10.00 (fake of course) and have him/her buy whatever he/ she wants. This activity will be in adding decimals.

Lesson 7 cont.

2. So as not to go over the $10. limit, the children should first begin by rounding off the prices to the nearest tenth (.79 =.80) This activity will be in rounding off decimals.

3. After their lists are completed, tell the children that, at anotherstore the prices are much cheaper. For example,
   all meats - 20% cheaper
   all vegetables - 10% cheaper
   all dairy - 10% cheaper
   all other groceries - 5% cheaper

   (the teacher may have to give assistance to categorize the foods)

4. Have the children redo their lists, changing the price of each item. This, activity will be in finding percentages and subtracting decimals, for the children will have to subtract the percent of discount from the original prices.
5. Have them compare their old total with their new total to see how much money they save (subtracting the decimals).
6. Have thewhole class discuss the usefulness of this activity.

Participation:
1. Whole class for instruction and discussion
2. Individual work for the food list activity
3. Whole class for the closing discussion

Conclusion:
Homework: Have children make a list of other ways that they could use percentages.

Lesson 8

Topic:Division of Decimals

Specific Goals:

1. The children will be able to divide decimals.
2. The children will be able to round off decimals to the nearest tenth, hundredth and thousandth place.
3. The children will see the relationship between finding the percentage of a number (previous lesson) and dividing two numbers to find the percentage.

Teaching Strategies:

1. Class instruction
2. Class discussion
3. Individual work

Materials:

1. Lists from the previous day.

The Plan:

1. Readiness Activities:
   a. Review of what was covered the day before and discussion concerning the homework.

Lessson Development:

1. Relate finding percentages to using percentages:
   3/4 = 75% and 75% of 4 (.75 X 4) =3

2. Explain the process of division by decimals (moving the decimal point of the denominator to the right, and then doing it for the same amount of spaces in the numerator)
   .35/.70 X 100/100 = 35/70

3. Refering to the food lists of the previous day, point out that they, knowing the percentage of discount, found the cheaper price of each item.
4. In this lesson, have them compare the old and new prices, and find the percent that one is cheaper than the other. (the answers thatthey will be finding will be the information that was given to them in the previous lesson)
5. Have a clsss discussion concerning the usefulness of both multiplication and division of decimals and how the two are related.

Participation:

1. Whole class for instruction and discussion
2. Individual work for comparing food prices
3. Whole class for the closing discussion

Conclusion:

Have the children do the word problems on the last page of the textbook for homework.

Lesson 9

Topic: Culminating activity for unit on decimals with an emphasis on the importance of math for many careers and occupations.

Specific Goals:

1. The students will be able to see directly how important math is for men and women equally in today's job market.
2. They will see that math involves them directly if they get any sort of job from working as a cashier to being an airplane pilot.

Teaching Strategies:

1. By getting the students to actively participate instead of just listen, they will understand to a greater degree how important math is for all jobs.

Materials:

Each student wil be responsible to bring in a different kind of hat, particularly hats that relate to job occupations. Students may make them out of paper.

The Plan:

1. Lesson development and discussion
   Have students divide up into groups of 4-5. Instruct them to make up skits using the different hat to represent different characters, i.e. each student is a different character, and the importance of mathematics or decimals for each occupation represented. Mock job interviews could be useful to reach this point. After giving each group about ten minutes to discuss their skit, have each perform theirs for the class.

Participation:

Each student will be participating in this activity, and the entire class will benefit by being able to work together in groups and see each other's skits, thus learning from each other.

Conclusion:

This activity could be followed by a short discussion.
For what kinds of jobs was mathematics most important?
" " " " not as important?
Did you feel underqualified for any job because you didn't know certain mathematical concepts or skills?
Why is it so important for women to know mathematics?
Are more women working today and what kinds of jobs are they doing?

Lesson 10

Topic: Decimals - Test

Name_____

Date_____

Read all directions and show all work!
(No calculators)

1. Write the fraction in decimal form:

1) $8\frac{469}{1000}$ 2) $84\frac{20}{100}$ 3) $6\frac{457}{1000}$ 4) $7\frac{81}{100}$

2. Multiply by .01

5) 638 6) 269 7) 32

3. Round off the the nearest whole number

8) 26.3 9) 7.89898 10) 100.39 11) 683.95 12) 999.99

4. Add/ Subtract

13) .61 + .79 14) 8.71 + .92 15) 2.83 - .48 16) .48 -.47 17) 1.94 - .95

18) 167.000 - 92.843

Write the fraction as a decimal and round off to the nearest hundredth.

19) 3/4 20) 2/5 21) 6/18 22 7/3

5. Multiply

23) 7.31 X.08 54.003 X.124

Divide

2.32)894.04 6.9)0889

6. Word Problems:

1. Ignatz is a sales girl. Her store is having a sale and everything is 30% off. If Herman buys a shirt there and it is originally $14.95, how much would the shirt be on sale?

2. Edna is a long distance runner who runs at the rate of 32.7 mph (miles per hour). If she runs to California in 13 ½ hours, how many miles has she run?

3. Zigried has a rich uncle who gave him $1894.98 for taking out the garbage. Zigfried wants to divide up the money as follows:

36% bank account 32% his dog
25% big sister 3% his tarantula

How much does each get and how much is left for you?

Grade Eight

Unit Plan

on

Percentages and Business Mathematics

by

Dr. Anne M. Claytor, S.C

Dr. Antoinette J. Messina

Eighth Grade

Percentages and Business Mathematics

1. Rationale:
   A. General Objectives:
      1. Understanding percentages
      2. Understanding profit and loss
      3. Reading charts
      4. Application of learned concepts to daily life

   B. Specific Objectives:
      1. Children will have knowledge of the definition of percentage, the uses of percentages in various fields, and how surveys help to obtain important information and statistics.
      2. To be able to set up and solve word problems relating to percentages and profit and loss.

Unit Content

Text: Webb, Rose and Ruth. Making Arithmetic Plain. Cincinnatic, Ohio, McCormeck-Mathers Publishing Company, Inc., 1964.

Lesson 1
Introduction to percentages, use in daily life. Distribution of survey.

Lesson 2
Conversions of fractions to percentages.

Lesson 3
Setting up percentage word problems

Lesson 4
Solving percentage word problems.

Lesson 5
Introduction to profit and loss, definition and use in daily life.

Lesson 6
Setting up word problems to profit and loss.

Lesson 7
Solving profit and loss word problems.

Lesson 8
Combining percentage and profit and loss problems together.

Lesson 9
Collect data from survey and make charts.

Lesson 10
Discuss survey and administer quiz on data.

Materials

1. Magazines, 2.colored paper, 3. scissors, 4. stapler, 5. markers, 6. chalk, 7. math paper, 8. pencils, 9. newspaper.

Activities

1. Each child (25 total) will question four friends in a survey.
2. Making charts of data from survey.

Culminating Activities

1. Summarizing - data of survey
2. Displaying - bulletin board
3. Evaluating - quiz

Estimated Time Schedule

Relationship to Other Curriculum Areas

1.Art - constructing bulletin board
2. Career Education - how percentages relate to various fields
3. Communication Skills - relating to other people

Other Teacher References

Lesson Plan 1

Topic: Introduction to Percentages

Specific Goals:

1. Children will know the definition of percentages.
2. The children will begin to develop an understanding of the various uses of percentages in the business world, and in daily life, in general.
3. The children will develop an understanding of the uses of surveys in gathering information for use in advertising medicine, psychology, and other areas.

Teaching Strategies:

1. Discussion
2. Sample questions - How many of you have brown eyes? Blue eyes? Other? etc.
3. Demonstration - Put results to sample questions on board and show how to convert fractions to percentages. (Gives basis for next lesson on conversions from fractions to percentages.)

Materials:

1. Paper 2. pencils 3. erasers 4. chalk

The Plan:

1. Readiness Activities:
   a. Show how conversions from fractions to percent are made. (May have to review multiplication of fractions.)

Lesson Development:

1. Discuss the definition of percent and the various uses of percentages in the business world and in daily life. Also, how surveys gather important information and statistics.
   a. Advertisers use surveys to find out how many people use their products and to see if current advertising techniques are effective in selling products.
   b. In medical research percentages are used to express effectiveness of products, the number of people with a common sickness, fatalities, etc. If researchers find that a particular population has a high incidence of a certain illness, then they may determine that there is something in that particular environment that is causing the sickness, etc.
   c. Psychological research - to find common symptoms and causes of various psychological disorders.
   d. Nielson Ratings for television programs.
2. Hand out survey with instructions.
   a. Each child (total 25) will ask four friends the question on the survey, keep a record of the answers, and bring the survey back to class within ten days.

Participation:

1. Whole class for discussion and demonstration.

Lesson Plan 2

Topic: Conversion of fractions to percentages

Specific Goals:

1. The children will learn how to convert fractions to percentages.

Teaching Strategies:

1. Explanation and discussion
2. Individual seatwork
3. Problems for homework

Materials:

1. Paper 2. pencils 3. erasers 4. chalk 5. ditto with problems

The Plan:

1. Readiness Activities:
   a. Review definition of percent (out of one hundred), set up fractions on board using data from sample questions in Lesson 1.

Lesson Development:

1. Using data from sample questions in Lesson Plan 1, set-up fractions on board.
2. Review definition of percent.
3. We want to know how many people out of one hundred,or what percent of the people would these fractions represent?
   Ex. 5/20 = ?/% Ans. = 25%
4. What did we do to 20 in order to get one hundred? (multiplied by five) Now do the same to 5, and what do you get? 25%.
   Do as many examples as needed until the children obtain a basic understanding of the concept.
5. Give them examples to work at their seats. They may ask questions individually if they still do not understand.
6. Take home for homework whatever is not completed by the end of the class period.

Participation:

1. Whole class for discussion and demonstration
2. Individual for seatwork and homework

Lesson Plan 3

Topic: Percentages in relation to fraction and how to set upword problems.

Specific Goals:

1. The children will be able to see how fractions and percentages relate to each other.
2. The children will also learn how to set upequations from word problems.

Teaching Strategies:

1. Discussion
2. Seat work
3. Board work

Materials:

1. paper 2. pencils

The Plan:

1. Readiness Activities:
   a. Review of fractions and percentages using diagrams and number problems. Introduce how to read word problems and how to set them up.

Lesson Development:

1. Put these problems on the board and have the class solve them at their seats:
   A. Write these in fraction form

= 3/8 = 37 1/2 % = 2/4 = 50%

= 6/12 = 50% = 1/4 = 25%

   B. Now explain to the class, that to get percentages of these (the previous problems) you divide the bottom number into the top number. Have them figure out the percentages at their seats. Have the students (you choose) write the answer on the board.

   C. Have the students write these numbers (percentages) as fractions. Teacher should write them on the board.

1. 40%	4. 5%	7. 9%
2. 35%	5. 12%	8. 10%
3. 60%	6. 75%	9. 55%

   Choose students to write the correct answers on the board.

   D. Read to the class these sentences and have them write in percentages you have just read,

Lesson 3 Cont.

1. 30 out of 100 pupils
2. 95 out of 100 points
3. 25 out of 100 cents
4. 3 out of 50 girls
5. 48 out of 52 dogs
6. 5 out of 25 colors
7. 15 out of 20 boxes
8. 50 out of 100 flowers
9. 7 out of 15 houses
10. 2 out of 5 children

2. Explain to the class how the following three terms are used in applying percentages to business problems.
   A. Base - refers to the total amount we are concerned with. For example:
      Sales tax is 5% of the purchase price. And the purchase price is the total amount we are concerned with, therefore the base.

   B. Rate - is the percent or fraction part we are concerned with. For example:
      In the sales tax problem, 5% is the rate, because it's 5% of the purchase price.

   C. Percentage - is the amount derived from the base by the rate. In the sales tax problem it would be the amount of the tax.

3. Have the students copy this information down.
   A. Percentage = Base X Rate = P= B X R

   B. $\text{Rate} = \frac{\text{Percentage}}{\text{Base}} = R = \frac{P}{B}$

   C. $\text{Base} = \frac{\text{Percent}}{\text{Rate}} = B = \frac{P}{R}$

4. For homework have the students listen to the radio or tv for instance where percentages are used. Have them look in the newspaper and see how percentages are used. In the sports section have them figure out what teams have won what percentage of the games they have played.

5. In class, work on these word problems dealing with percentages. Explain to them that tomorrow they will discuss their findings from tv and newspaper.

Lesson 3 Cont.

A. Objective here is to be able to find a percent of a number.
   1. One horse won 9 out of 15 races. What percent did he win?
   2. Tom had $48.00. If he spent $6.00 on a shirt, what percent of his money was left over?
   3. Mrs. Jones estimated that a crate of 15 heads of lettuce was lost due to spoilage. What percent was spoiled?
   4. An 840 lb. steer weighed 462 lbs. after slaughter. What percent was waste?
   5. 36 pupils were in a class. Thirty-six of them went on a field trip. What percent went?

B. Objective here is to be able to find a number when a percent of it is unknown.
   1. Andy played 10 games of darts. If he won 60% of the games, how many did he win?
   2. A restaurant buys 15 dozen eggs per week. Usually about 3% are broken. About how many are left?
   3. There are 40 pupils in a math class; 65% of them are boys. How many of them are girls.
   4. Ten percent of 5 dozen heads of lettuce spoiled. How many heads were spoiled?
   5. A race horse ran 8 races and lost 25% of the time. How many races did he lose?

Participation:

The whole class participated in the discussion. The class wrote the answers on the board.

Conclusion:

1. Students turn in papers (problems) when finished.
2. Have students bring to class (next meeting) the examples they heard or saw of percentages.

Lesson Plan 4

Topic: Solving business percentage word problems.

Specific Goals:

1. The class will learn how to set up equations from business word problems and solve them.

Teaching Strategies:

1. Discussion
2. Board work
3. Seat work

Materials:

1. student percentage example from home 2. paper 3. pencils

The Plan:

1. Readiness Activities:
   a. Give the answers to the problems that were assigned yesterday. Discuss the percentage examples the students brought in from home.

Lesson Development:

Mimeograph word problems for each student. Have them solve the problems at their seats.

1. Jerry wished to buy a home costing $25,000. He finds that the loan company requires a 20% down payment. How much must he have for a down payment?
   Ans. $5000.

2. A used car salesman sells a car for a price of $675. His commission is 7% of the sales price. How much does he make from the deal?
   Ans. $47.25

3. The property tax in a certain area is 6.25% for the year. What is the total tax for a house which is evaluated for tax purposes at $12,000?
   Ans. $750.

4. George Garcia borrowed $500. from a loan company. He is paying back the amount in instalments of $50. per month for one year. What is the percent of interest of his loan?
   Ans. 20%interest

5. Harold Garfield examined his paycheck stub. He earned $174. His deductions left him with $127. take home pay. What percent of the money he earned did he actually take home?
   Ans. 73%.

6. Authorities estimated that 25% of the registered voters turned out for a special election. 37,500 ballots were cast. How many registered voters were there?
   Ans. 150,000

7. Al Martin buys shoes for his store at $12.00 per pair. He plans to sell the shoes at 15% more than he paid for them. What does he sell the shoes for?
   Ans. 13.80

8. Ohio has a state sales tax of 4%. A cashier finds she had sales for the day of $124.80. This amount includes tax. How much of this total was tax?
   Ans. $4.80

Participation:

After the students have completed their problems, have individuals work the problems out on the board.
Whole class discusses the problems.

Conclusion:

Have class discuss and summarize lesson.
Have class hand in their problems.

Lesson Plans 5 and 6

Topic: Stocks

Specific Goals:

1. The children will understand the basic fundamentals of stocks.
2. The children will be able to discuss the effects on stocks increase and decrease in business.

Teaching Strategies:

1. Discussion: class will discuss stocks using newspaper.

Materials:

1. Stock page 2. graphs

The Plan:

1. Readiness Activities:
   a. The children understand the concepts of profit and loss. They are able to dtermine profit or loss on small scale.

Lesson Development:

1. Go over homework problems, review.
2. The children will learn the purpose and benefits of stocks.
3. A discussion on how buying and selling of stock influences business.
4. The children will be able to discuss basic aspects of stock. ex. the eight categories meaning on the stock page, what happens when a stock increases or decreases?
5. The class will find the percentage increase or decrease in a stock on two consecutive days.

Participation:

The whole class will be involved.

Conclusion:

A review of the major points of the past three lessons will help the children to think of them in terms of interwoven concepts.

Lesson Plan 7.

Topic: Word Problems

Specific Goals:

1. The children will be able to change mathematical word problems into mathematical equations. Then with their previous math knowledge they will be able to solve these equations, which in turn is also solving the word problem.

Teaching Strategies:

1. Discussion
2. Demonstration
3. Observation
4. Set up Game

Materials:

1. Chalk, 2. Black Board 3. Pencils 4. Paper

The Plan:

1. Readiness Activities:
   a. Review division, multiplication and setting up of simple word problems.
   (i.e. If JOe bought 5 cookies at 10¢ each and 5 at 20¢ each, how much did he spend? (I would in a sense warm them up.))

Lesson Development:

1. Speak with the students about their interest.
2. With their interests known, you can divise a word problem(s) in that area so they have at least some interest in their work.
3. Let children gather in groups of similar intersts.
4. While they are doing this, make up a few word problems in each area.
5. At the board, explain how to do the word problems, step by step.
6. After you feel they have an understanding of how to do the problems, give them a few to do on their own.
7. Walk around and help those who are having problems.

Participation:

1. Set up game so that every interest group has the same amount of students in each group.
2. Set up relay races with teams of:
   1. Two students to change the problem into a math equation,
   2. Two students to do the math,
   3. One student to write the answer on the board.

   The students should change positions after each race.

Conclusion:

1. Set up one word problem and put it on the board.

Lesson 7 cont.

2. Starting with the first seat ask the children to work the problem out.
   (i.e. If Mickey Rivers stole 50 bases in 1976, 40 in 1977, and 47 in 1978, how many did he average?
   Teacher(to first child): What would you do first?
   First child: I would add.
   Teacher (to second child): Add what?
   Second child: I would add 50, 40 and 47 together.

3. Continue process until the problem is solved. If it takes two problems to get the entire class involved,use problems as long as the children feel as if they are working as a unit to solve the problem.

Lesson Plan 8

Topic: Changing percents to profits and losses in dealing with word problems.

Specific Goals:

1. The children will understand how to change percents into profits and losses.
2. They will understand why and how it relates to real life dealings with money.

Teaching Strategies:

1. Discussion
2. Demonstration
3. Observation
4. Set up Game

Materials:

1. Chalk 2. black board 3. pencils 4. paper 5. newspaper

The Plan:

1. Readiness Activities:
   a. Review word problems, changing fractions to decimals to percents to fractions.

Lesson Development:

1. Go to the board and demonstrate various problems dealing with the topic.
2. Work slowly and go step by step.
3. After you feel that it was explained well, ask the students if they like horses.
4. Then ask if anyone ever bet on the horses.
5. If someone did, have him explain how the system works. If they can't, then you should explain.
6. After that, pick eight students to make paper airplanes.
7. Stand them up in front of the room and put odds on each one.
8. Tell the students to make fake bets on which plane will fly the farthest.
9. Let them bet as much as they want.
10. Do this about five times and have each student tally up how much they won or lost.
11. Then have them figure out how what percent they won or lost compared to the amount bet.

Conclusion:

1. Explain how stocks work.
2. Then tell the students to pick a stock and write down how much they want to put down on the stock.
3. Set up a bulletin board with their picks and after a month have them find out what percent of money they have gained or lost.

Lesson Plan 9

Topic: Percentages

Specific Goals:

1. The students should understand what percentages represent and what they mean. They should understand how surveys are taken and what they represent.

Teaching Strategies:

1. Discussion
2. Collection of data

Materials:

1. paper 2. scissors 3. stapler 4. magazines.

The Plan:

1. Readiness Activities:
   a. Review of conversion of percentages.

Lesson Development:

1. Collect data from survey and post on board
   a. What are the averages of each?
   b. How many people of the survey have dogs as pets?
   c. How many people does 20% represent out of 100?

Learning Stations:

1. Have children prepare bulletin board.
2. What is the best way we can represent our survey?
3. How should we set up our charts?

Participation:

1. Small groups for preparing board.
2. Entire class for discussion of what the survey means.

Conclusion:

1. Finished bulletin board.
2. Discuss why surveys are made.
3. Discuss what other surveys students are aware of.
4. Discuss what surveys mean.

Lesson Plan 9 cont

Survey

L. What is your shoe size?

	1	2	3	4
Girls	3-4	5-6	7-8	9-
Boys	3-6	7-9	10-12	13-

2. What kind of pets do you have? dog cat fish other

3. Where do you go on vacation? beach country lake other

4. How many times has you family moved?
0 1 2 3 or more

5. How many sisters and brothers do you have?

1 1-2 3-4 5 or more

6. What is your favorite flavor of ice cream?

van choc straw other

7. How tall are you?

Girls	4' or less	4'1"-4'9"	4'10"-5'5"	5'6"-
Boys	4'5" or less	4'6"-5'2"	5'3"-5'9"	5'10"--

*. Favorite sport? basketball baseball or softball football otner

Lesson Plan 10

Topic: Percentages

Specific Goals:

1. The children will understand what the difference is between mean, mode and median.
2. They will be able to compute each.

Teaching Strategies:

1. Discussion
2. Application on other materials.

Materials:

1. Paper 2. pencils

The Plan

Readiness Activities:

a. Review data from survey

Lesson Development:

1. What other surveys have you heard of?
2. On what occupations could we take a survey?
3. What would be the mode of family income?
4. What is the mean of family income?

Learning Stations:

1. Have children mark off the mode, mean and median on the charts.
2. Discuss which would be more valid in this situation and why.
3. Discuss where the other measures would be more valid.

Participation:

1. Whole class discussion on the purpose of the survey.
2. Small groups in marking off mean, mode and median.

Conclusion:

Conduct a survey of occupations held by your family and family friends.

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Unit Plans

Observations and Evaluation of Teachers

by:

Dr. Anne M. Claytor, S.C.

Dr. Antoinette J. Messina

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Chapter IV

Pre and Post Testing of Experimental Teachers and Students

Introduction

This chapter explains the results of the pre and post testing in attitude and occupational preference for teachers in grades three through eight. Also included is similar data for female and male students in experimental classes, grades three through eight, as well as pre and post test scores for mathematical achievement derived from the Comprehensive Tests of Basic Skills.

Teacher Pre and Post Test Survey

The experimental teachers in grades 3-8 were compared statistically in the pre and post test areas of: "Mathematical Attitudes" (Arlin-Hills Attitude Survey), "Weighted Occupational Preference" (Both (3), Female (2), and Male (1)), and individual preference and choices for "Both", "Female", and "Male".

Comparing the post test scores with the pre tests, as shown in Table 9, the post testing on mathematics attitudes shows that all of the teachers except one showed a favorable preference. (Range difference +7 to +39). The fourth grade teacher showed an increase in post test score of 39 over the pre test score. The fifth, sixth and seventh grade teachers scored between 7 and 9 points higher than the pre test scores while the third grade teacher's score showed a decrease of 4 points. There was no difference between the eighth grade teacher's scores. The norm score was established at 30, and all the teachers were above it on the post tests except the third grade teacher whose score was close at 29.

As shown in Table 9, the weighted scores for occupational preference indicated that the experimental teachers' post test scores were close to a perfect score of 150 with the exception of the third and sixth grade teachers whose scores were 126 and 109 respectively. Only the fifth grade teacher had a significantly higher post test score (150 compared with 98). The teachers in grades four and eight had differences of two to four points while the seventh grade teacher remained the

same. The individual sex preference for occupations where teachers checked "Both", "Female", and "Male" revealed that the teachers felt most occupations listed in the survey could be performed by both males and females. However, the choice between female and male showed that male was more often chosen. Except for the third and sixth grade teachers the scores were relatively low for male occupational preference.

N.B. As noted in the Addendum to the Teacher Personal Data, there was a change of personnel in the sixth grade after the pre-testing period.

Table 9

Experimental Teachers Pre and Post Test of Math Attitude and Occupational Preference

Exp. Grades	Math Attitude			Weighted Occ. Pref.			Unweighted Occ. Pref.							
							Pre				Post			
	Pre	Post	Diff.	Pre	Post	Diff	Both	Fem	Male	T	Both	Fem	Male	T
3	29	29	0	150	126	-24	50	0	0	50	38	0	12	50
4	0	39	+39	150	148	-2	50	0	0	50	49	0	1	50
5	26	33	+ 7	98	150	+52	16	16	18	50	50	0	0	50
6	31	40	+ 9	150	109	-41	50	0	0	50	28	3	19	50
7	27	35	+8	150	150	0	50	0	0	50	50	0	0	50
8	40	40	0	144	148	+4	47	1	2	50	49	0	1	50

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Student Pre and Post Test Surveys

Third Grade

The data was grouped for each grade level 3-8 with separate categories for male and female. In the third grade as indicated by Table 10, the majority showed scores above the norm of 25 in the Arlin-Hills Attitudes Survey in both the pre and post tests. There was a slight decline of one student in the boys' scores above 25, while the girls showed a slight increase of 1 student above the norm of 25. Above average scores were recorded for male and female students in the pre and post test survey of occupational preference. There was no change in the boys' scores, while the girls showed a slight decrease. The number of boys' scores above 3.0 in mathematical achievement increased from 1to 6, while the number of girls' scores above 3.0 rose from 0 to 6.

Fourth Grade

Table 10 shows that on the Arlin-Hills Attitude Survey post test there was a decrease of 2 male students in the scores above the norm of 25. In contrast the girls showed an increase of 4 students above the norm of 25. At the same time, above average scores were recorded for both male and female student in the pre and post testing of the Occupational Preference Test. There was a slight difference in the boys' scores but the girls scores remained the same. There was an increase of 8 boys with scores above 4.0 and an increase of 4 girls with scores above 4.0 in math achievement.

Fifth Grade

As shown in Table 10 the males, in contrast to the females, showed a slight decline in the number of students with scores above the norm of 25 in the Arlin-Hills Attitude Survey. Both males and females revealed strong gains in the weighted scores of the Occupational Preference Survey. The increases and improvement were strongly apparent from grades five through eight. The boys increased their scores by 4 with scores above 5.0; the girls increased their scores by 5 with scores above 5.0 in mathematical achievement.

Sixth Grade

The Arlin-Hills Attitude Survey revealed for the sixth grade male a slight decline in number from belowthe norm score of 25 for the boys. In contrast, the girls recorded no change. Becoming obvious with the fifth grade, the scores for both males and females showed improvement in the Occupational Preference post testing. Unlike the other grades tested, the sixth grade boys' scores dropped below 6.0 by 8, while the girls' scores dropped below 6.0 by 10 in mathematical achievement. (See addendum regarding change in experimental teacher for this class.)

Seventh Grade

The seventh grade male and female students had above average scores on the Arlin-Hills Attitude Survey. In the post test the females' overall scores showed no change with most above the norm of 25. On the other hand, the males showed improvement and two students moved to the score above 25. The pattern was

almost similar in the weighted scores on the occupational preference. Four males and one female moved to scores in the 150-102 range. The scores of both the girls and boys in this class above 7.0 increased by 4 in mathematical achievement.

Eighth Grade

Comparing the pre and post test results of the Arlin-Hills Attitude Survey the male students showed no change while the females had a slight decline on one student in the scores above 25. The male students in the occupational preference showed improvement in their weighted scores while the females showed a decline. The data in more detail is shown in Table 10. The scores of both the girls and boys in the class above 8.0 increased by 3 in mathematical achievement.

Table 10

Experimental Students Pre and Post Tests of

Math Achievent, Math Attitude, Occupational Preference

Grade	Sex	Math Achievement **				Math Attitude #				Occupational Preference *			
		Grade	PreNo	PostNo	Diff.	Score	PreNo.	PostNo	Diff	Score	PreNo	Post No	Diff
3	M	above 3.0	1	6	+5	above 25	4	3	-1	150-102	3	3	0
		below 2.9	5	0		below 24	2	3	+1	101- 51	3	3	0
										50- 0	0	-	-
	F	above 3.0	0	6	+6	above 25	4	5	+1	150-102	3	2	-1
		below 2.9	6	0		below 24	2	1	-1	101- 51	3	4	+1
										50- 0	0	-	-
4	M	above 4.0	2	10	+8	above 25	9	7	-2	150-102	10	9	-1
		below 3.9	10	2		below 24	1	3	+2	101- 51	1	2	+1
										50- 0	0	-	-
	F	above 4.0	4	7	+4	above 25	6	10	+4	150-102	10	10	0
		below 3.9	7	4		below 24	4	0	-4	101- 51	0	-	-
										50- 0	0	-	-
5	M	above 5.0	0	4	+4	above 25	9	7	-2	150-102	3	11	+8
		below 4.9	12	8		below 24				101- 51	9	1	-8
										50- 0	0	0	-
	F	above 5.0	0	5	+5	above 25	11	13	+2	150-102	1	13	+13
		below 4.9	14	9		below 24	3	0	-3	101- 51	13	1	-12
										50- 0	0	0	-
6	M	above 6.0	14	6	-8	above 25	0	8	-2	150-102	7	9	+2
		below 5.9	0	8		below 24	4	6	+2	101- 51	7	5	-2
										50 - 0	0	0	-
	F	above 6.0	13	3	-10	above 25	9	8	-1	150-102	7	8	+1
		below 5.9	0	10		below 24	4	5	+1	101- 51	6	5	-1
										50- 0	0	0	-

Table 10 Cont.

Grade	Sex	Math Achievement ** Grade	PreNo	PostNo	Diff	Math Attitude # Score	PreNo	PostNo	Diff	Occupational Preference * Score	PreNo	PostNo	Diff
7	M	above 7.0	5	9	+4	above 25	7	9	+2	150-102	4	8	+4
		below 6.9	4	0		below 24	2	0	-2	101- 51	5	1	-4
										50- 0	0	,0	-
	F	above 7.0	10	14	+4	above 25	15	15	-	150-102	11	13	+2
		below 6.9	6	2		below 24	1	1	-	101- 51	5	3	-2
										50- 0	0	0	0
8	M	above 8.0	2	5	+3	above 25	5	5	-	150-102	3	5	+2
		below 6.9	6	3		below 24	3	3	-	101- 51	5	3	-2
										50- 0	0	0	0
		above 7.0	6	9	+3	above 25	9	8	-1	150-102	13	10	-3
		below 6.9	7	4		below 24	4	5	+1	101- 51	0	3	+3
										50- 0	0	0	0

* Weighted Score: Both (3), Female (2), and Male (1).

Arlin-Hills Attitude Survey

** Comprehensive Test of Basic Skills

Summary

An overview of grades three through eight reveals in the post testing that in the Arlin-Hills Attitude Survey no significant changes were recorded in the female and male populations.

The results on the Occupational Preference Survey showed only a slight change in the third and fourth grade post test results. However, from grades five through eight the number of both male and female student showed large increases in the weighted scores of 150-102.

The results of the Comprehensive Tests of Basic Skills in Mathematical Achievement likewise showed large increases in post test scores in all grades except grade six where there was a large decrease in the scores of both the girls and the boys. (See notation regarding the change in the experimental teacher for the sixth grade class).

Apparently the emphasis placed on the necessity for mathematical knowledge and ability for so many current occupations open to both females and males helped to raise both the scores in occupational preference as well as mathematical achievement. The results in the mathematics attitude surveys were not surprising, since a great deal of time is needed to change attitudes.

Recommendations

As a result of this research project, the following are some recommendations for the mathematics supervisor of the district of Asbury Park to consider:

1. Include the general focus of the project "Expanding Career Choices for Students by Reducing Mathematics Anxiety" in the mathematics curriculum each semester.

2. Continue teacher workshops so that current topics will make the mathematics curriculum increasingly relevant.

3. Form discussion groups among teachers for the exchange of innovative teaching strategies and techniques as proposed through the teaching units in this project.

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WOMEN AND MATHEMATICS

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AFTER HIGH SCHOOL-WHAT? $.15 each.
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Engineering Council for Professional Development, Guidance Department, 345 East 47th Street, New York, NY 10017
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CAREERS IN STATISTICS. American Statistical Association, 806 15th Street, N.W., Washington, D.C. 20005.
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A series of career opportunity booklets, including information on educational background, training, salaries, working conditions and status of women. Some examples: "Launching a Career", "Considering a Career in Engineering".

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One page description of careers, including education & training required, status of women in field, salaries, colleges awarding bachelor's degrees in the field and addresses for further information. Photos depict women using tools of their trade or profession.

I'M MADLY IN LOVE WITH ELECTRICITY AND OTHER COMMENTS ABOUT THEIR WORK BY WOMEN IN SCIENCE AND ENGINEERING, by Nancy Kreinberg. (1977). Lawrence Hall of Science, University of California, Berkeley, CA 94720. $1.00
Quoted comments from 70 women about the work they do and the opportunities in their fields. Private corporations, government laboratories and community colleges and universities on the west coast are represented.

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interdisciplinary nature of science is well presented. The importance of parallel careers - programmer, scientific librarian and secretary - is presented.

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One page leaflet introducing the opportunities for women in trade and technical fields. Lists skills that can be learned at NATTS schools and course lengths.

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A few of the many publications designed for junior and senior high school students dealing with various occupations and the training they require.

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Excellent description of various job opportunities in area of physics, educational requirements, etc. Quotations and pictures of women in physics.

WOMEN IN SCIENCE, by Dinah Moche. (197). American Association of Physics Teachers, Publications Department, Graduate Physics Building, SUNY at Stoney Brook, Stoney Brook, NY 11794. $27.00.
A multimedia package presenting information about six women scientists, including written materials, audio cassette tapes and 35 mm slides. A pamphlet describing package is available.

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Program includes 20 minute film interviewing several women engineers, activity books for students of different age levels. Women engineers in Bell system are also available to serve as speakers. Designed for junior and senior high school students - particularly girls. Leaflet describing program is available.

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AN ANNOTATED BIBLIOGRAPHY ON WOMEN AND MATHEMATICS: A HISTORICAL PERSPECTIVE

HYPATIA'S SISTERS: BIOGRAPHICS OF WOMEN SCIENTISTS - PAST AND PRESENT, edited by Susan Schacher. (1976). Feminists Northwest, 5038 Nicklas Place N.E., Seattle, WA 98105. $2.00.

Short biographical sketches of well known and lesser known women from 300BC to present.

THE LADIES DIARY...CIRCA 1700, by Teri Perl. (April. 1977). Mathematics Teacher. 354-358.

An account of the Ladies' Diary, an 18th century journal for women. Includes sample mathematical puzzles and problems.

MATH EQUALS, by Teri Perl. (1978). Addison-Wesley Publishing Company, Menlo Park, CA.

Biographics of 10 prominent women mathematicians plus activities designed to provide experiences of doing mathematics. Level gold for high school.

EMMY NOETHER, by Clark H. Kimberling. (February, 1972). American Mathematical Monthly. 136-149.

Brief account of Noether's life and contributions.

THE WITCH OF AGNESI - EXORCISED, by Hubert C. Kennedy. (October, 1969). Mathematics Teacher. 480-482.

Discusses facts and fiction about Agnesi.

WOMEN IN MATHEMATICS, by Lynn Osen. (1974). MIT Press, Cambridge, MA.

Biographical sketches of 7 prominent mathematicians: Hypatia, Emilie du Chatelet, Maria Gaetana Agnesi, Sophie German, Mary Fairfax Somerville, Sonya Kovalevsky, Emmy Noether.

SEX DIFFERENCES AND ANXIETY RELATIVE TO MASTERING MATHEMATICS: AN ANNOTATED BIBLIOGRAPHY

THE CORPORATE WOMEN: UP THE LADDER, FINALLY. Business Week (November 24,1975). McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, NY 10020.

Status report on women in executive positions, including comments by several women executives.

EQUALS: AN ANNOTATED BIBLIOGRAPHY TO ASSIST ELEMENTARY AND SECONDARY SCHOOL TEACHERS IN SEX-FAIR COUNSELING AND INSTRUCTION, by Valerie Wheat. (August, 1977). Equals Institute, Laurence Hall of Science, University of California, Berkeley, CA. $1.00.

FURTHERING THE MATHEMATICAL COMPETENCE OF WOMEN, by Nancy Kreinberg. (1976). Public Affairs Report, 17, No. 6. Institute of Government Studies, 109 Bernard Moses Hall, University of California, Berkeley, CA 94720. Single copy free.

INTELLECTUAL TALENT: RESEARCH AND DEVELOPMENT, edited by Daniel P. Keating. (1976). John Hopkins University Press.

Proceedings on a symposium in early childhood education. Of special interest are "Sex Differences in Mathematical Precacity: Bridging the Gap" and "Career Related Interests of Adolescent Boys and Girls".

MATH ANXIETY, by Sheila Tobias. (September, 1976) MS. 56-59.

Introduces concept of math anxiety; summarizes research of Sells and Ernest on math avoidance; reports on Math Anxiety Clinic at Wesleyan University and Lenore Blum's work at Mills College.

MATHEMATICS AND SEX, by John Ernest. (October, 1976). American Mathematical Monthly. 83, 595-613.

An article reporting research results covering student and teacher attitudes, sex differences in attitudes. Includes excellent bibliography.

MATHEMATICS LEARNING AND THE SEXES: A REVIEW, by Elizabeth Fennema. (May, 1974). Journal for Research in Mathematics Education, 126-139.

Reports on 36 studies involving preschool through high school students. Emphasizes that existing sex differences can be overcome by effective teacher training programs.

MIND OVER MATH, by Stanley Kogelman and Joseph Warren. (1978). Dial Press, New York, NY. $7.95

OVERCOMING MATH ANXIETY, by Sheila Tobias. (1978) W. W. Norton & Company, Inc., New York, NY. $10.95.

SEX DIFFERENCES IN MATHEMATICAL ACHIEVEMENT: A LONGITUDINAL STUDY, by Thomas L. Hilton and Gasta W. Berglund. (January, 1974). Journal of Educational Research, 231-237.
An investigation of sex differences in mathematics achievement. Fifth grade students are tested in 1961 (and again in 7th, 9th and 11th grades.) Results show no difference in grade 5, but after that the boys were ahead.

SEX EQUALITY IN EDUCATIONAL MATERIALS. (1975). Volume IV of AASA Executive Handbook Series. American Association of School Administrators, 1801 N. Moore street, Arlington, VA 22209. Single copy $1.00.
Report on the problems found in many textbooks. A discussion about what can be done.

SEX RELATED DIFFERENCES IN MATH ACHIEVEMENT AND RELATED FACTORS: A FURTHER STUDY, by Elizabeth Fenema and Julia A. Sherman. (May, 1978). Journal for Research in Mathematics Education, 9, No. 3 189-203.

UPDATE ON ATTITUDES AND OTHER AFFECTIVE VARIABLES IN LEARNING MATHEMATICS, by Lewis R. Aiken, Jr. (Spring, 1976). Review of Educational Research, 46, No. 2, 293-311.
A survey of research - many references.

THE WOMEN AND MATHEMATICS PROGRAM: A PRELIMINARY STATISTICAL EVALUATION, by L. Denby, S. J. Devlin and E. L. Poiani. (1977). 1977 Social Statistics Section Proceedings of the American Statistical Association.
A preliminary evaluation of WAM, written for the person well versed in statistical techniques.

WOMEN AND MINORITIES IN SCIENCE AND ENGINEERING. (1977). National Science Foundation, Stock No. 038-000-00307-1. U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402.

WOMEN IN MATHEMATICS: PROBLEMS OF ORIENTATION AND REORIENTATION, by Edith A. Luchens. Department of Mathematics, Rensselaer Polytechnic Institute, Troy, NY.

WOMEN AND MATHEMATICS

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INSPIRATIONAL MATERIALS: AN ANNOTATED BIBLIOGRAPHY

THE MAN MADE WORLD (1971). Engineering Concepts Curriculum Project, McGraw-Hill Book Company.

MATHEMATICS: A HUMAN ENDEAVOR, by Harold R. Jacobs. (1970). Freeman and Company, San Francisco, CA.
The subtitle tells it all, "A text book for those who think they don't like the subject."

MATHEMATICS AND THE MODERN WORLD, by Mario F. Triola. (1973). Cummings Publishing Company, Inc., 2727 Sand Hill Road, Menlo Park, CA 94025.
Students with a basic knowledge of algebra will understand this intuitive description of such topics as algebra, calculus, statistics and topology. Also discusses mathematics in the social sciences and humanities.

MATHEMATICS IN LIFE: SKILLS, CONSUMER AND CAREER APPLICATIONS, by L. Carey Bolster and H. Douglas Woodbum. (1977). Scott, Foresman and Co., Glenview, IL.
Exercises in basic skills practice with emphases on practical applications. FUN!

A NEW TWIST, by Jean J. Pedersen and Frank O. Armbruster. (1978). Addison-Wesley Publishing Co., Menlo park, CA.
A book of problems to strengthen mathematical concepts.

APPENDIX A

TEACHERS' PERSONAL DATA

Present Grade _____

TEACHER PERSONAL DATA
MATHEMATIC PROJECT

Complete anonymity and confidentiality will be maintained. No individual name will be connected with the report of the findings.

Name _____ Age _____

Address _____ City _____ State _____

College(s) attended _____ Major _____ Degree ____ Date __
_____ Major _____ Degree ____ Date __
_____ Major _____ Degree ____ Date __

Were you ever a non Education Major ____ Yes ____ No. If "Yes" what was previous major(s) _____

Years of teaching experience _____ List grade levels taught _____

Years of other experience _____ Explain _____

_____

No. of previous positions before Asbury Park _____

Specify present gross income _____

List Membership in Professional Organizations _____

_____

_____

_____

Offices held _____

_____

List membership in Civic Organizations _____

_____

_____

_____

Offices held _____

_____

Explain other data considered pertinent _____

_____

_____

(if necessary use back side)

APPENDIX B

TEACHER AND STUDENT ATTITUDES

TOWARDS OCCUPATIONS

ASBURY PARK BOARD OF EDUCATION

ATTITUDES TOWARDS OCCUPATIONS

Grade Level_____ Male_____Female_____

Below is a list of occupations. Next to each occupation are three columns: "Both", "Female", "Male". For each occupation, check the line you think is the type of person that could or should have the job. If you do not know what the occupation is, leave the spaces blank.

	Both	Female	Male		Both	Female	Male
Cook	___	_____	___	Airline Attendant	___	_____	___
Fashion Designer	___	_____	___	Police Officer	___	_____	___
Baker	___	_____	___	Dentist	___	_____	___
Doctor	___	_____	___	Newspaper Reporter	___	_____	___
Engineer	___	_____	___	Fire Fighter	___	_____	___
Teacher	___	_____	___	Pilot	___	_____	___
Librarian	___	_____	___	Babysitter	___	_____	___
Car Dealer	___	_____	___	Judge	___	_____	___
Secretary	___	_____	___	Telephone Operator	___	_____	___
Store Owner	___	_____	___	Accountant	___	_____	___
Disc Jockey	___	_____	___	Auto Mechanic	___	_____	___
Bookkeeper	___	_____	___	Athlete	___	_____	___
Pharmacist	___	_____	___	Truck Driver	___	_____	___
Butcher	___	_____	___	Florist	___	_____	___
Principal	___	_____	___	Artist	___	_____	___
Interior Decorator	___	_____	___	Carpenter	___	_____	___
T.V. Newscaster	___	_____	___	Poet	___	_____	___
Travel Agent	___	_____	___	Chemist	___	_____	___
Chef	___	_____	___	Lifeguard	___	_____	___
Nurse	___	_____	___	Bricklayer	___	_____	___
Architect	___	_____	___	Plumber	___	_____	___

-2- (Continued)

ASBURY PARK BOARD OF EDUCATION

ATTITUDES TOWARDS OCCUPATIONS

	Both	Female	Male
Dancer	____	_____	____
Chemist	____	_____	____
Chauffeur	____	_____	____
Housekeeper	____	_____	____
Factory Worker	____	_____	____
Bus Driver	____	_____	____
Musician	____	_____	____
Banker	____	_____	____
President	____	_____	____

APPENDIX C

TEACHER ATTITUDE TOWARDS MATHEMATICS

Teacher Attitudes Toward Mathematics

Grade Level_____ Male_____ Female_____

Directions: Please write your name in the upper right hand corner. Complete confidentiality will be maintained. No individual will be named in the final report. Each of the statements on this opinionnaire expresses a feeling which a particular person has towards mathematics. You are to express, on a three-point scale, the extent of agreement between the feeling expressed in each statement and your own personal feeling. The three points are: Agree(A), Undecided (U), Disagree (D). You are to encircle the letter which best indicates how you agree or disagree with the feeling expressed in each statement AS IT CONCERNS YOU.

1. I was always under a terrible strain in a Math class.	A	U	D
2. I did not like mathematics, and it scared me when I took courses in it.	A	U	D
3. Mathematics was very interesting to me and I enjoyed math courses.	A	U	D
4. Mathematics is fascinating and fun.	A	U	D
5. Mathematics makes me feel secure, and at the same time it is stimulating.	A	U	D
6. My mind goes blank, and I am unable to think clearly when working math.	A	U	D
7. I feel a sense of insecurity when attempting mathematics.	A	U	D
8. Mathematics makes me feel uncomfortable, restless, irritabl and impatient.	A	U	D
9. The feeling that I have toward mathematics is a good feeling.	A	U	D
10. Mathematics makes me feel as though I'm lost in a jungle of numbers and can't find my way out.	A	U	D
11. Mathematics is something which I enjoy a great deal.	A	U	D
12. When I hear the word Math, I have a feeling of dislike.	A	U	D
13. I approach math with a feeling of hesitation, resulting from a fear of not being able to teach math.	A	U	D
14. I really like mathematics.	A	U	D
15. Mathematics was a course in school which I have always enjoyed studying.	A	U	D
16. It makes me nervous to even think about having to teach a math problem.	A	U	D

-2- (Continued)

17. I have never liked math, and it is my most dreaded subject.	A	U	D
18. I am happier teaching a math class than anyother subject.	A	U	D
19. I feel at ease in teaching mathematics and I like it very much.	A	U	D
20. I feel a definite positive reaction to mathematics; it's enjoyable.	A	U	D

Appendix D

Arlin-Hills Attitude Towards

Mathematics (Primary)

ATTITUDE TOWARD MATHEMATICS
PRIMARY

We would like to know how you feel about working with numbers. Blacken in the circle with a pencil to show how you feel. Fill in only one circle for each question. YOUR TEACHER WILL NOT SEE THIS -- Your answers will go straight into the computer.

	NO	SOMETIMES	USUALLY	YES
1. Working with numbers is too hard.	0	0	0	0
2. Working with numbers is fun	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
3. I like working with numbers	0	0	0	0
4. Working with numbers is boring	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
5. I like to work with numbers even when the teacher doesn't make me	0	0	0	0
6. I like to get out of working with numbers whenever I can	0	0	0	0

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	NO	SOMETIMES	USUALLY	YES
7. It's fun to work out answers to number problems	0	0	0	0
8. Hard number problems make you freeze up	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
9. Working with numbers is a waste of time	0	0	0	0
10. Working with numbers is good because it makes you think	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
11. Working with numbers is an easy subject . . .	0	0	0	0
12. Working with numbers takes too long	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
13. Working with numbers is my favorite subject	0	0	0	0
14. It is fun to work with numbers outside the classroom	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
15. It's too easy to make a mistake working with numbers	0	0	0	0

Appendix E

Arlin-Hills Attitude Towards Mathematics (Elementary)

ATTITUDE TOWARD MATHEMATICS
ELEMENTARY

We would like to know how you feel about arithmetic. Blacken in the circle with a pencil to show how you feel. Fill in only one circle for each question. YOUR TEACHER WILL NOT SEE THIS -- Your answers will go straight into the computer. Have fun!

	NO	SOMETIMES	USUALLY	YES
1. Arithmetic is too hard.	0	0	0	0
2. Working with numbers is fun	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
3. I like arithmetic	0	0	0	0
4. Arithmetic is boring	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
5. I like to do arithmetic even when the teacher doesn't make me.	0	0	0	0
6. I like to get out of arithmetic whenever I can.	0	0	0	0

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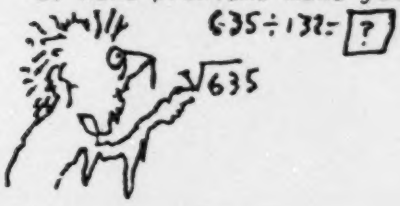
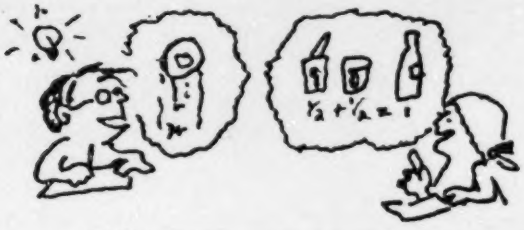
	NO	SOMETIMES	USUALLY	YES
7. It's fun to work out answers to arithmetic problems	0	0	0	0
8. Hard problems make you freeze up.	0	0	0	0



	NO	SOMETIMES	USUALLY	YES
9. Arithmetic is a waste of time	0	0	0	0
10. Arithmetic is good because it makes you think	0	0	0	0



	NO	SOMETIMES	USUALLY	YES
11. Arithmetic is an easy subject	0	0	0	0
12. Arithmetic takes too long.	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
13. Arithmetic is my favorite subject	0	0	0	0
14. It is fun to do arithmetic outside the classroom.	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
15. It's too easy to make mistakes in arithmetic	0	0	0	0

Appendix F

Arlin-Hills Attitude Towards Mathematics (Secondary)

ATTITUDE TOWARD MATHEMATICS
SECONDARY

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We would like to know how you feel about mathematics. Blacken in the circle with a pencil to show how you feel. Fill in only one circle for each question. YOUR TEACHER WILL NOT SEE THIS -- Your answers will go straight into the computer. Have fun!

	NO	SOMETIMES	USUALLY	YES
1. Mathematics is too hard	O	O	O	O
2. Working with numbers is fun	O	O	O	O

	NO	SOMETIMES	USUALLY	YES
3. I like math	O	O	O	O
4. Math is boring	O	O	O	O

	NO	SOMETIMES	USUALLY	YES
5. I like to do math even when the teacher doesn't make me	O	O	O	O
6. I like to get out of math class whenever I can	O	O	O	O

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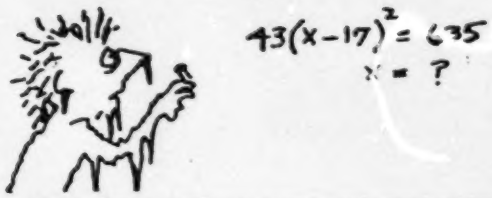
	NO	SOMETIMES	USUALLY	YES
7. It's fun to work out answers to math problems	0	0	0	0
8. Hard problems make you freeze up	0	0	0	0



	NO	SOMETIMES	USUALLY	YES
9. Mathematics is a waste of time	0	0	0	0
10. Math is good because it makes you think	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
11. Math is an easy subject	0	0	0	0
12. Math problems take too long	0	0	0	0

	NO	SOMETIMES	USUALLY	YES
13. Math is my favorite subject	0	0	0	0
14. It is fun to do math outside the classroom	0	0	0	0

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	NO	SOMETIMES	USUALLY	YES
15. It's too easy to make mistakes in math . .	0	0	0	0

Appendix G

Discussion Questions for Students Given in Second Teacher Workshop

Post-Viewing Activities

1. Ask two volunteers, a male and a female, to role-play the following job interview:
   - A woman is being interview by a man for a position selling small home appliances door to door. The man has already decided that he does not want a woman salesperson.

   When the students are well into their roles, the male student should take the role of the job applicant, and the female student should take the role of the interviewer. After a few more minutes, ask for two other volunteers to play the following job interview:
   - A man is applying for a nursing position. He has good credentials. A woman head nurse is interviewing him. Midway in the interview have the two role players reverse positions and continue the process.

   Class discussion of both of these role-playing situations may center on the following themes:
   a. the use of myths and stereotypes in the interview process
   b. the difficulty of getting to know a person within a short time span
   c. how it feels to try to counter myths and stereotypes

2. This activity is designed to help students become aware of the important part a career plays in the alternatives they might have for themselves and their would be spouses. Students are to answer and then discuss the multiple choice questions that follow.
   - What would you do if you were offered a higher career position, you wanted it, and it required relocation?
   a. forget it or not consider it seriously
   b. try to convince my family to move
   c. insist my family move
   d. move with or without my family
   - Repeat the question, but substitute <u>your spouse for you</u>.
   - You have been requested to put in longer hours at your job. This means you spend less time with your family and will not be able to go on a planned vacation. What do you do?
   a. quit your job
   b. go on vacation but work longer hours
   c. feel guilty about your family, miss the vacation, and work longer hours
   d. feel happy to please your boss and advance your career
   - Repeat the question, substituting <u>your spouse for you</u>.

   Themes for discussion might be the importance of work for <u>you</u> and for <u>your spouse</u> and the possibility of alternative

standards for you and your spouse.

3. The purpose of this activity is to help students consciously consider their possible career choices and the consequences of the choices in terms of work style and lifestyle. Students should select three areas of strong career choice, ranking them 1, 2, 3, in order of preference, and then fill in the chart on page 14. (below)

	Career Choices 1	2	3
Is it more traditionally male or female?			
What is the work environment of the job?			
What does the work schedule allow you to do at home?			
What type of financial responsibility does the work allow?			
What conflicts will you have on the job due to sex?			
What difficulty will you have getting the job due to sex?			
What type of help will you need from your family for your job?			

Source: Women at Work: Choice and Challenge Part II